ARCTIC

OLUME 5, NUMBER 1 · MARCH 1952

OURNAL OF THE ARCTIC INSTITUTE OF NORTH AMERICA

THE ARCTIC INSTITUTE OF NORTH AMERICA

The Arctic Institute of North America was formed to further the scientific study and exploration of the Arctic. The Institute provides information on the Arctic through its three Offices, awards research grants, and publishes scientific papers and other contributions in its journal *Arctic*. Those interested in this work are invited to become Associate Members. Associates receive all numbers of the journal. The Library and Map Collection at the Montreal Office are principally for their use, and they are welcome there and at the other Institute Offices. Dues are $3.00 annually and may be paid in Canadian currency and forwarded to the Montreal Office, or in United States currency and forwarded to the New York Office.

Offices of the Institute

3485 University Street, Montreal, Que., Canada
1530 P Street N.W., Washington 5, D.C., U.S.A.
Audubon Terrace, Broadway at 156th Street, New York 32, N.Y., U.S.A.

ARCTIC

Journal of the Arctic Institute of North America

Vol. 5, No. 1 Published in Ottawa, Ontario **MARCH 1952**

CONTENTS

A. L. WASHBURN

The decision of the Board of Governors of the Institute, in early 1945, to ask Lincoln Washburn to take on the Executive Directorship, proved a wise and a happy one. Dr. Washburn, known to his very large circle of friends as "Linc", came to Montreal in the same year and set up office in the Institute headquarters. During his six years as Executive Director, he saw the headquarters moved twice, from the top floor of the administration wing of the McGill University Arts Building to the Ethnological Museum, then housed in the Medical Building, and from there to the present offices in Bishop Mountain House. He left Montreal in March 1951 to establish the Washington Office, and in this present year he has given up his close administrative connection with the Institute for other work in which he will continue his great interest in furthering arctic research.

The Institute is very greatly indebted to Dr. Washburn; it was he, more than anyone else, who set the pattern of its early development. His great devotion to his work, his gift for detail and his thoroughness have constantly amazed his associates, and it is to these qualities of his that the sound foundation of the organization can surely be ascribed. His work for the Institute did not appear to cease day or night, as witness the many guests on social occasions in his home who found themselves suddenly involved in impromptu committee meetings in the corner. Much of the financial endowment which started the work of the Institute, and which still carries it on, was due to Dr. Washburn's energy and enterprise.

His tact and modesty gained him firm friends in both capitals, but it was in Montreal that he became perhaps better known to Institute friends than anywhere else, especially to the Arctic Associates of Montreal. He became a well-known figure at McGill University, and there was a real feeling of loss when he moved south to Washington.

No appreciation of the work of Dr. Washburn, in Institute matters, could omit warm and special tributes to his wife. Tahoe Washburn was an important member of the team; her charm, cheerfulness, verve and warmth will never be forgotten in Montreal. She accompanied her husband on several of his northern expeditions, and she became known to many as the hostess of the Washburn home on Westmount Mountain, which came to be a natural Mecca for arctic people going through the city; a sort of unofficial hostelry of infinite hospitality.

There are remarkably few United States citizens who achieve real understanding of Canadian problems and points of view, even though they may live in Canada for many years. The Washburns are two who undoubtedly did, and the importance of that understanding to the welfare of the Institute can scarcely be over-rated. (It was even said that Linc Washburn was gradually changing his pronunciation of the very word "Institute"!). From the standpoint of those in Montreal it was a great pity that for various good reasons he felt he had to return to the United States, and in so doing had to relinquish the Executive Directorship. It goes without saying that he will remain in continued close association with the Institute, which will continue to benefit from his experience and wise help.

M. J. Dunbar

THE UNGAVA BAY PROBLEM

M. J. Dunbar*

In a civilized and increasingly complex world, native and primitive peoples become farther and farther removed from the apex of civilization, unless they are assisted and educated to keep pace with, or to approach, that civilization. This disparity in tradition and outlook becomes the more striking and the more serious where the two cultures touch one another, as when civilized man encroaches upon the economy of the native to such an extent that the original native economy has been totally disrupted and the native has become more and more dependent on the civilized man.

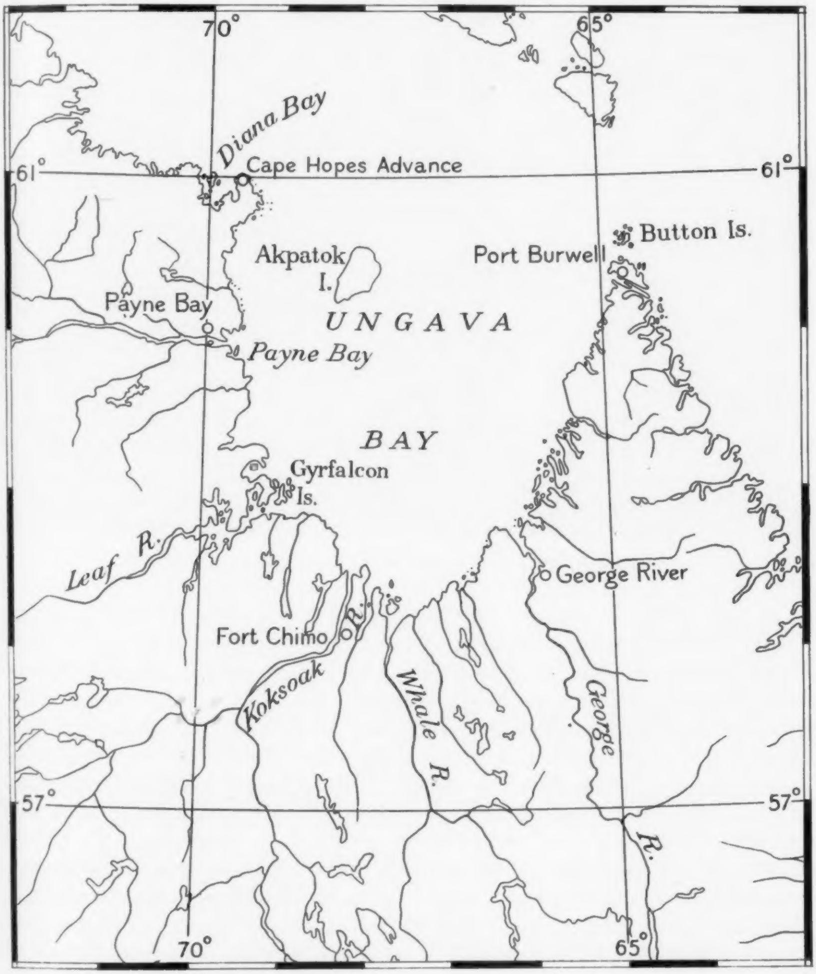
In these circumstances the native can be easily and completely corrupted by the acceptance of unfamiliar moral standards which do not apply to his own historic experience, and he can become so dependent on the white man's trade that he loses his original arts of hunting and travelling, and is then unable to look after himself if the economy of the white man deteriorates, or even fluctuates.

These ill effects have been demonstrated in many instances all over the world. It follows that there is an obligation on the white man to protect the native, or so to manage the affairs of the native that he survives—and this obligation rests on government rather than on the trading companies as such. In some parts, as in Greenland, the two have been the same; there was until recently, a government trading monopoly in Greenland. If they are not the same, as in northern Canada, it is still the concern and obligation of government to manage the affairs of the native peoples within the national boundaries, because the private trading company, which is commercially interested, may not be able or willing to undertake the cost of the recuperation of the native economy, especially when the deterioration of that economy has gone as far as in the Ungava Bay region of Canada. Government then reaps the reward of having at some earlier time ,taken the risk of entrusting the affairs of the native to private interests.

There are two possible points of departure in a process of rebuilding the native economy and morale: (1) to attempt to assimilate the native population immediately into the activities of civilized man in the area; and (2) to attempt to put the native economy back on a footing as near as is reasonable to the original—at least to base it once more firmly on the real wealth of the native region—and to graft in, gradually, the patterns of civilization in the process. Both these policies carry the assumption that the ultimate civilization of the native population is inevitable, if not desirable.

The first alternative, although it seems to be popular at present, may be unworkable. A lengthy period of unearned support and of education is necessary before the native people are ready to take part in civilized activities,

*Associate Professor of Zoology, McGill University.



such as radio communication, air traffic, and mining. They can, of course, be used simply as cheap labour, in which case they are being frankly exploited and have no hope of ever being anything else. Assuming that the objective is better than that, what is to happen in the period of education and apprenticeship, which may last for a whole generation? If they are allowed to continue to lose their original economy and means of livelihood, they become a direct charity load on the public exchequer, to the detriment of both the native and the exchequer.

The wiser course is the second, in fact it is probably the only course that is likely to succeed. In Greenland, where the process of introducing the native fully into civilized life is in mid-swing, the amalgamation of native

Calanus in Calanus Harbour, Button Islands, August 1949.

traditional life and introduced civilized economy is the explicit policy of the Danish Administration. The principle has always been that the economy of Greenland should be based on the real wealth—the seals, the fish, and the fur—of the country, with assistance from mineral wealth when and where found. There was no deterioration of the native life comparable with what is happening now in Canada, although such a condition was threatened in the eighteenth century, leading to the formation of the Royal Greenland Trading Company in 1774, and the management of all trade in Greenland as a government monopoly.

In Canada, at least in some parts of the Eastern Arctic, including Ungava Bay, there is a certain amount of back-tracking to be done before a sound condition is reached from which the process of civilized advancement can begin. It should be emphasized—for this is a point which, it seems, is not digested on first presentation—that the time-scale in this matter may be large. Significant changes in the economic habits of a human group cannot be made in a few years, perhaps not in less time than a few generations. It has taken two hundred years to achieve the present stage of results in Greenland, and though the pace there has been deliberately kept down, those two centuries of time must serve as a warning and a lesson to us in Canada who have begun, so recently, what the Danes began in Greenland so long ago.

Ungava Bay is a body of salt water, along the shores of which live less than one thousand Eskimo, who tend to concentrate at the trading posts of Payne Bay, Fort Chimo, and George River. From Port Burwell to Cape Hopes Advance is about 150 sea miles, and it is somewhat less than that from Akpatok Island to the mouth of the Koksoak River in the south. Trapping

Port Burwell, July 1949.

at Payne Bay is still good enough to warrant keeping the trading post open there, and Chimo serves as a trading post not only for the Eskimo, but for the small Indian population which formerly traded at Fort Mackenzie before that post was closed in 1948. It is understood that George River is to be closed in 1952, and the post at Leaf River was closed some years ago. There is no post now at Diana Bay, which lies just outside Ungava Bay, and the post at Port Burwell was closed in 1941.

Clearly the fur trade on the shores of Ungava Bay is not booming. The condition of the trade is of course reflected in the Eskimo, who are poor, and rely heavily upon family allowances and Government relief. They tend more and more to collect at the posts themselves, especially Chimo, and their diet contains too high a proportion of store-food—white flour, hard tack, lard, and tea. Their state of health is poor; on this point the writer has no details to publish, nor are any apparently available. The general initiative is correspondingly low.

The low state of enterprise and energy results, as would be expected, in reduced hunting and fishing activity. This, combined with the growing strength of the feeling that "the Government owes us a living", forms a depressing picture. One group of natives was willing, when it was suggested, to go up the Payne River after white whales which were known to be there, but expected as a matter of course that the necessary gasoline for fuel should be given them free. The gasoline was not forthcoming, and the whale hunt did not take place. Examples of this sort are fairly common. The reduced activity in hunting in turn reflects upon the nutrition of the natives, and so the process is circular, and spiralling downwards.

Fur is not the only resource that is in short supply. It must be said, in defence of the reluctance of the Eskimo to go hunting, that the rewards are not overwhelming. Caribou are becoming increasingly scarce, by all accounts, and according to report suffered a major, and unexplained, setback about 1918, when the migrating herd which usually crossed the Koksoak River

Peterhead boats at Chimo, July 1947.

each year, failed to appear. It has not appeared since. The sea mammals, although present, are not abundant in Ungava Bay, and moreover the season of good hunting is very short—about three weeks in June and July between the break-up of the ice and its disappearance from the bay. Almost all the ice has gone, in an average year at this point in the climatic cycle, by the middle of July. The seal, especially the ringed seal (*Phoca hispida*), leave with the ice; only a few bearded seal (squareflippers, *Erignathus barbatus*), and fewer harp seal (*Phoca groenlandica*) and ringed seal, remain in the open water for the rest of the summer. Even so, the number of seal sighted during four summer seasons' field work in Ungava Bay is not so small as the low hunting activity would lead one to suppose, and the families still energetic enough to go sealing can make considerable kills. One record, admittedly very exceptional, is that of a camp in the southwest part of the bay in 1947, consisting of two families in five tents, with two Peterhead boats and three

kayaks, which landed 79 ringed seals and 42 squareflippers in a period of about three weeks, in late June and July. Coming in to the mouth of the Koksoak River on 2 September 1950, the *Calanus* sighted about 12 harp seal, some 6 bearded seal, and a number of ringed seal, and groups of bearded seal were recorded in all four seasons both before and after the disappearance of the ice.

The winter hunting conditions on the ice are apparently very unsafe owing to the extremely large tidal range and the strong tidal currents; consequently there is little seal hunting in the winter.

It is not clear whether there has actually been a decline in the sea mammal population of Ungava Bay, or whether these waters have always, or for a long time, been comparatively poor in them. One native at Fort Chimo told the writer that "about 40 years ago" walrus were common at the Gyrfalcon Islands, in the southwest part of the bay, but it is doubtful whether great credence should be given this report without corroboration from other sources. Walrus now are common only at Akpatok Island, at certain times of year, where they are occasionally hunted by the natives of Payne Bay and the Cape Hopes Advance region, until the ice leaves the island in July. For most of the natives of Ungava Bay, walrus scarcely figure at all in the annual cycle.

It is conceivable that the recent warming of the marine (and atmospheric) climate of the Atlantic Subarctic, which has so strongly affected the west Greenland coast, has caused a reduction in the sea mammals of Ungava Bay, but it can scarcely be considered probable. It is true that the waters of Ungava Bay, at least the overlying layers, are subarctic—influenced, that is to say, by Atlantic water—and that such subarctic indicators as the Atlantic cod (*Gadus callarias*) and the Atlantic salmon (*Salmo salar*) are present in certain parts, but there is good evidence for the presence of both these forms at least as far back as the 1880's, so that recent hydrographic changes can hardly be postulated. Unfortunately, the first observations of salinity and temperature in Ungava Bay were made in 1947, and we have therefore nothing from which to construct the hydrographic history of the bay.

If any reduction in the sea mammal population has taken place, it is most probably the result of the use of the rifle by the Eskimo, and of the coarsening of the native hunting skill. From observation of Eskimo hunting in Ungava Bay during four seasons, the *Calanus* expeditions came to the conclusion that for every seal landed during the summer, three are lost owing to sinking, the seals having been killed by rifle fire from a distance, far out of harpoon range. Such a waste of a natural resource would never be tolerated among the fish and game circles in civilized communities, but it has been going on for years in the north, every summer. It has led to the natural conclusion that the seal population must be declining. It may be, but we have no proof of it.

Whatever the present status of the seal and walrus populations, it is certain that even were a return to the hunting manners of their forefathers possible, it would not solve the present economic problems of the Eskimo of Ungava Bay.

The establishment of an air base near Fort Chimo might have had as little effect upon the Eskimo as the Greenland bases have had upon the Greenlanders.

In the early years of the war the air bases in Greenland were declared out of bounds to the native population, and similarly the native settlements were off limits to military personnel, in fact to all personnel from the military establishments, with the result that the price structure carefully maintained by the administration over several generations did not suffer, and there was no deflection of the constructive efforts of the Greenlanders into the labour requirements of the airfields and weather stations, which for the native is a blind alley. At Chimo, however, and also at other northern airfields in Canada, there was no effort made to keep the natives off the base limits. They were welcomed, settled down in villages, and proceeded to forget a little more of the habits of independence. Employed as help in the mess, as unskilled labour, and a few as truck drivers, they gained a false sense of big-time importance, and the scorn or secret envy of their less evolved compatriots, according to the points of view of the latter. They became a little farther removed from an economy based on the real resources of their country, and the future holds nothing for them but the continuation of their present lot for as long as the work exists for them—or for as long as they wish it—and after that a return to the failing economy of the Ungava Bay Eskimo as a group, with still less mental equipment to deal with that problem than they had before.

It is of course a great saving to the white man engaged in building or maintaining a northern airfield to be able to employ local native labour at two dollars a day, rather than to be forced to import expensive white labour; and the glib official good intentions of those who wish immediately to "integrate the Eskimo with the march of civilization in the north" fit all too well into this saving of expense; but it is possible that such published intentions reflect a complete ignorance of the highly complex problems involved, or else an equally dangerous unwillingness to face them. The history of Indian affairs in the United States, with the object lessons of the dangers of walking into the slough of the easy way out, is before us; and the extraordinary complexity of the labyrinths through which it is now necessary to feel one's way back are well shown up by such studies as Dr. Laura Thompson's book 'Culture in Crisis' on the Hopi Indians, or Mr. John Collier's 'Indians of the Americas' on the American Indians in general. It is very important to realize that the feeding and clothing and shelter of the Eskimo is not by any means the whole of the question, and that the consequences to the native mentality of what amounts to a brutal dislocation of their traditional ways of life, and ways of thought, can cause irreparable damage. It appears that in all human affairs the mental damage wrought is the hardest to repair. To put the Eskimo problem in Ungava Bay in the picturesque terms used by the Brazilian natives employed in one of the Fawcett searches—their souls may never catch up with their bodies.

In 1947 the Fisheries Research Board undertook the study of the physical and biological oceanography of Ungava Bay, with a view not only to putting our knowledge of those waters (and of other Eastern Arctic seas) on the approximate level reached by other countries in other parts of the north, but

also to discovering, if possible, hitherto unused marine resources which could be developed by or for the Eskimo. Ungava Bay was found to be unsuitable for trawling or for normal commercial exploitation, but certain possibilities were brought to light at Port Burwell, and Burwell became fixed, in the mind of the present writer, as a possible key to the problem of Ungava Bay. Before dealing with this in any detail, it will be necessary to describe briefly the history of fishing activities of all kinds in this region. It is not a long history.

The Atlantic salmon reaches its northerly limit in Canada in the rivers of Ungava Bay, from the Koksoak eastward. The salmon start to run between late July and the third week in August. The run is variable in extent, and therefore unreliable as a source of food for man or dogs. Nevertheless the salmon is of some importance economically to the Eskimo of Ungava Bay, and the unreliability of the upstream run is therefore a matter of considerable concern to them. The fish are taken in gill nets. The present annual catch on the Koksoak River probably varies between about 10 and 40 300-lb. barrels. The catch in 1947 was estimated at about 35 barrels, in 1948 less than 12 barrels. The George River catch was approximately the same in 1947 as on the Koksoak, but in 1948 less than 5 barrels were obtained.

It is possible that the salmon fishery was damaged by commercial fishing which began in 1881 (on the Koksoak; 1884 on the George and Whale rivers), and continued until the early 1930's. Both the total catch and the average weight began to decline as soon as the fishery opened. About 40 tons of fish were frozen for shipment in 1881, average weight 19 lbs.; 24 tons in 1882, average weight 16 lbs.; 38 tons in 1883, average weight 14.5 lbs., and less than 40 tons in 1884, average weight 14.7 lbs. In 1899 A. P. Low reported that the salmon fishery had steadily declined and that in 1897 it had been an almost complete failure. The present status of the salmon population is uncertain.

The arctic char (*Salvelinus alpinus*) occurs in all suitable rivers in the area; in the southern part it is replaced in some of the smaller streams by the speckled trout. During the upstream migration it is caught in gill nets and with long-poled gaffs, and in much smaller numbers it is taken also in the winter, in lakes. It does not appear to support so important a fishery as does the salmon, no doubt because the latter is the larger and therefore the more valuable fish to the Eskimo. As is usually the case with the arctic char, it could be subjected to considerably greater fishing by the native population, if the activity were spread over the many streams which are now hardly touched at all. Intensive fishing on one river, however, would probably do serious harm.

There is a certain amount of winter fishing on the lakes, with gill nets set beneath the ice, for lake trout and whitefish.

It will be observed that there is no salt water fishing in the above account. Apart from the netting of salmon and char in tidal stretches of rivers, the jigging of a few sculpin, and the catching of the occasional codfish (at Burwell), there is no sea fishing activity in the bay. While it is possible that both salmon and char fishing, particularly the latter, could be developed by

the Eskimo, these two resources could not provide the volume of native or "country" food necessary to restore the economy to health. Salt water fishing at Burwell, however, might save the situation.

It is significant that Burwell, the least attractive of the Ungava Bay settlements from the point of view of the fur trader, should appear as the richest of them all from the point of view of the old-style Eskimo. There is no doubt that it is. Burwell is on the route of one of the groups of harp seal on their fall migration to Newfoundland, in October and November, and this alone assures the few Eskimo left there of enough seal for almost the whole year. Burwell also lies close to the Button Islands, which can usually be relied upon to provide good seal hunting throughout the open season (the islands cannot normally be reached in the winter). Ringed seal, harbour seal (*Phoca vitulina*), harp seal, and squareflippers are all taken in summer at the Button Islands by the Burwell natives, although the shortage of good boats makes the visits somewhat rare. Polar bear are occasionally shot there. The waters in the immediate vicinity of Burwell itself also appear to be richer in seals, especially bearded seals, than the remainder of Ungava Bay.

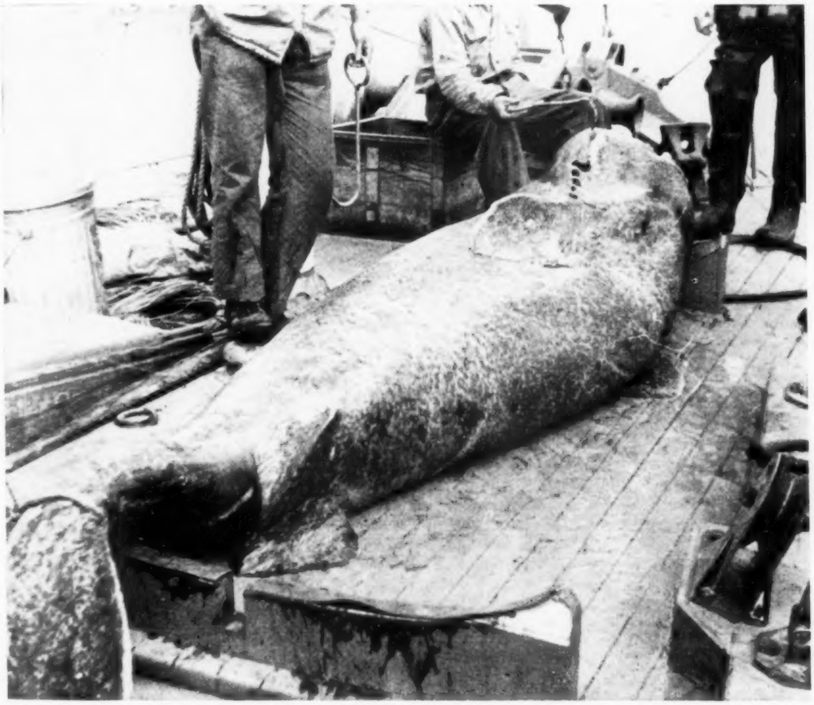
It is not surprising that the few Eskimo who did not leave Burwell in 1941 when the post was abandoned (there are now about twenty of them) should be the best situated in the bay. The surprising and depressing thing is that so few stayed, that the majority preferred to follow the trade-store to George River or Chimo.

Burwell stands out from the other points in the Ungava Bay coast in one other respect—it is the only place where a marine fishery could be developed. Atlantic cod (*Gadus callarias*) spend some ten weeks at least in the Burwell area, from the latter part of July to the end of September approximately, and can be caught by hand-line at the rate of about 20 fish per man-hour, or a little higher. The fish are fairly small, up to about 75 centimetres, but they are good eating. The Greenland shark (*Sommiosus microcephalus*) is common, and could also be used, once the Eskimo gets over his aversion to the shark. Sharks are a nuisance to the seal hunters, who seem somewhat scared of them, and they have never learnt, as the Greenlanders have, the value of the liver, or to use the dried flesh for dog-food; and they are quite unaware that there exists anywhere a market for the skin.

Marine fisheries, and the possibility of marine fisheries, are rare in the Arctic. They belong to the Subarctic and to zones farther south, and it is worth observing that the Eskimo, who have arrived in Greenland and the Labrador by arctic routes, have not developed marine fisheries to any significant degree by themselves, but only with the initiative and help of white men. Where marine fisheries have been developed they have proved of vital importance to the native, especially in west Greenland, where the cod fishery is now by far the biggest single industry. The Burwell area of Ungava Bay, it should be emphasized again, is subarctic, so far as the sea is concerned.

In Ungava Bay, it is clear that the one group of Eskimo who do not need help, by the development of fisheries or anything else, is the little Burwell group, and yet it is there that a possible solution of the Ungava Bay

problem as a whole is to be found, in cod fishing and shark fishing. The general objective of a "Royal Commission on Ungava Bay" might be the turning of the Eskimo's attention to Port Burwell, and the stimulation of a native fishery there which would provide salted, frozen, or possibly dried fish for distribution to other points along the coast, for human and canine consumption. (The Burwell climate is not well-suited to drying fish.) This development would involve the summer migration of some of the natives from



Greenland shark (12-foot) on deck of *Calanus*, August 1949.

Chimo, Payne Bay, and George River, to Burwell; it would at the same time bring them to better sealing waters, and they might be able to remain, after the fishing, for part or all of the period of migration of the harp seal.

The bare bones of this scheme are easy to draw. There are practical problems involved, none of them, I believe, insoluble. For the proper operation of such a fishery, there will be a need for: (1) a small processing station at Burwell; (2) more boats; (3) the education of the Eskimo, and (4) a system of internal trade in Ungava Bay which will both distribute the fish economically and fit it into the established summer activities, such as salmon fishing and sealing. It will require, at first, a capital outlay on a small scale and the system will probably not pay for itself in the first few years. Almost certainly it

must be administered by government, but it would be wise to do it rather more economically than many Government enterprises in the north.

An experimental fishery station was in fact set up in 1950, by the Northern Administration of the Department of Resources and Development, and the few Eskimo at Burwell were induced to catch codfish with hand-lines, for their own use. Some 6,000 fish were salted away. The enterprise was strictly experimental, intended to demonstrate the scale upon which such a fishery could be maintained. The fact that the salt fish were not immediately con-

Peterhead boats at Payne Bay, July 1947.

sumed by the Eskimo is immaterial—it has already been pointed out that the Burwell natives themselves do not need the fishery.

Apart from one Peterhead boat which the Hudson's Bay Company moved from Lake Harbour to Port Burwell in 1951, in connection with a possible fishery there, there has been no new boat brought into Ungava Bay for many years; and the present state of the fur trade does not suggest that the purchasing power of the native will be able to bring them, in the foreseeable future. It is understood that arrangements are being made at present for the building of whaleboats at certain northern trading posts, including the Ungava Bay region, and this may considerably ease the present shortage. For the distribution of Burwell fish to other parts of the bay, however, at least one larger vessel will be required, perhaps a 50-foot boat with good cargo space, which could be beached at Fort Chimo each winter. Such a vessel could also transport some of the Eskimo engaged in the Burwell fishing. Small dories are best for the actual fishing, which would be largely by hand-line—long-line does not appear

to be a useful method at Burwell—but native-owned whaleboats and Peterhead boats could also be used. These latter boats at present have gasoline engines. With gasoline at a dollar a gallon, it would probably be better to change over at some time to diesel engines, and to induce the Eskimo to re-learn some of their old sea-going habits and use sail alone whenever possible. There is seldom any prolonged absence of wind in Ungava Bay.

The problem of the education of the Eskimo is far wider than the present matter of the development of a fishery at Burwell, but the fishery is one of the kind of things for which they have to be educated. Only two points need be made here; first, that we are disgracefully late in introducing adequate schools in the north, and second, that much of the ordinary grade school curriculum is not appropriate to Eskimo purposes. The Eskimo needs to know precisely what his position is in the modern world, and what the real foundations of his present economy are. For this he needs to learn English, a little mathematics, some practical mechanical and electrical engineering, and some biology—not the kind that demonstrates that under certain circumstances a bean will germinate, which he knows already, but the kind that deals with the balance of natural populations, including his own. Whether he becomes a little Protestant or a little Catholic is a secondary consideration. If the curriculum is specially designed for the Eskimo, and if the teachers themselves know what the present issues are in the north, the schools will be a great success. If our own educational system is simply moved north, and if the teachers imagine that teaching the Eskimo is in no way different from teaching anyone else, the schools might as well not be built.

The system of internal trade best suited to the fitting of a marine fishery into the Ungava Bay economy is essentially an *ad hoc* problem; it can be adapted to the immediate situation. Certain things can be foreseen, however. Those who leave Chimo or George River to fish for cod will miss the salmon fishing. This should not reduce the salmon take significantly, if at all, since the number of nets operated can be held constant, but the salmon fishers may produce a surplus over and above their own needs. The cod fishermen certainly will produce a surplus, especially the native Burwell population who may have no need for the fish at all. Some system of barter, therefore, will be necessary. The seal take at Burwell will be increased, much of which will be taken back to Chimo or George River; some could be traded for spruce logs from Chimo, just as sealskins from Payne Bay are at present sometimes traded for firewood from Chimo. Depending on the extent to which the Government or trading company are involved, it may be best to buy some of the cod with cash, and to open a trade-store at Burwell. The cod so purchased would then be taken to other coastal points in the fall. Certain of the products of such a fishery might be saleable in outside markets, such as shark- and cod-liver oil, and shark leather. Possibly a cooperative system could be developed.

Many old hands in the north may not like these ideas. Eskimo, they may say, will not fish for cod; they will not eat salt fish; they will not touch shark, and so on; to all of which one obvious counter is that the native

population of Greenland is engaged in shark and cod fisheries, and the salt can be leached out of the fish. It could also be pointed out that there must have been a time when the trapping of foxes seemed just as foolish a novelty to the Eskimo hunters as cod fishing may seem today, and that their employment at air bases must come less naturally to them than going to Burwell to fish. Moreover, there are other new things on the way. Mining, for instance, may open up on Ungava Bay any year, on a large scale. If Eskimo can be employed in mining operations, they can also go fishing for cod, and moreover the mining companies (and the personnel at air bases or weather stations) would provide an immediate market for some of the fish.

The argument has also been raised that there is not time for such a development as has been suggested here, that the problem of bringing the Eskimo into the march of civilization is immediate. The Eskimo, it could be maintained, is highly adaptable, and would come to no harm by such a rapid transition from hunter and trapper to miner or radio technician, and he could learn the necessary techniques very quickly.

A third, and not very admirable point of view might be that it is not worth all this trouble; less than 1,000 people are involved in Ungava Bay, and besides they have little political importance. Such an attitude does exist. It can be firmly rejected, but it cannot be ignored.

There is, in fact, plenty of time to follow the general policy advocated in the early part of this article. If at the same time it is possible to train Eskimo quickly to become skilled as well as unskilled labour, well and good; at least we must have the proper schools. And in general, the two cardinal rules of policy in handling the Eskimo problem should surely be: (1) no charity (beyond the usual matters of the aged and the disabled), and (2) use the local resources to the utmost, consistent with their conservation.

AN OUTLINE OF THE ARCHAEOLOGY OF PEARY LAND

Eigil Knuth*

PEARY LAND marks the northernmost as well as the easternmost extent of the former Eskimo territory. Geographically the name covers only the most northerly peninsula of Greenland, which to the south is separated from the neighbouring territories of northeast Greenland by Independence Fjord, some 150 miles long and up to 20 miles wide. Archaeologically, however, the south coast and ramifications of Independence Fjord should be included in the Peary Land region, which thus extends from latitude 81°N. in the south to 83°40N. in the north. The peninsula, which is some 16,700 square miles in area, is the largest ice-free region in Greenland, and its northern part, the most northerly of all known land.

Peary Land is almost 180 degrees east of the easternmost Eskimo territory in Bering Strait. However, Point Barrow, the northernmost point on the Alaskan mainland, is as much as 750 miles south of Peary Land, that is about half-way between the extreme south and north points of Greenland. Thus, climatic conditions for the inhabitants in ancient times, as well as opportunities for the archaeologist looking for traces of them, are very different from those of the archaeologically-rich districts of Alaska, where Larsen and Rainey (1948) were able to find ruins of a whole village site at Ipiutak.

Eskimo settlement in Peary Land has been on a modest scale, and the yield of our archaeological work, under the difficult conditions of snow-covered areas often at 40 degrees below zero, was also modest. Only a few hundred objects were brought home against tens of thousands from the Alaskan excavations. However, certain facts justify a description of the Peary Land observations. Because of the scarcity of settlements in Peary Land some culture evidence has been preserved with undisturbed, clear lines which distinctly divides the two complexes of modern Eskimo archaeology, paleo-Eskimo and neo-Eskimo. Our finds in the paleo-Eskimo complex are of particular interest as they correspond to the recent archaeological discoveries in Alaska.

The Arctic Whale Hunting Culture

Peary Land has been a transit region for Eskimo migrations from Arctic North America to northern East Greenland,[1] and there is evidence that some at least of the migrations may have passed from the northern part of Ellesmere Island via Robeson Channel to the north coast of Greenland, thus by-passing the Thule district. The neo-Eskimo were, as might be expected, the latest arrivals, and the most important evidence of their stay in Peary Land was found at Herlufsholm Strand, the flat southeasterly point of the peninsula just north

*Leader, Danish Pearyland Expedition, 1947-50.

[1]The use of capital letters for East and West Greenland indicates the political, not the geographical region. *Ed.*

Fig. 1. Umiak frame at Herlufsholm Strand, shortly after discovery on 11 May 1949.

of the mouth of Independence Fjord. Here, on an almost snowfree gravel terrace facing the pack ice of the Arctic Ocean, we found the frame of an Eskimo whaling boat or umiak, which was over 35 feet long (Figs. 1 and 5), and about one hundred metres in front of it, under deep snow, there was a number of camping grounds full of abandoned utensils. For the present the objects may be described as of types characteristic of the Thule Culture: whaling harpoon heads, ground slate blades, sled-shoeing, trace buckles, and baleen implements (Fig. 2). The animal bones collected indicate hunting of the following animals: Greenland whale (*Balaena mysticetus*), narwhal (*Monodon monoceros*), bearded seal (*Erignathus barbatus*), ringed seal (*Phoca hispida*), muskox (*Ovibos moschatus*), reindeer (*Rangifer tarandus*), and arctic fox (*Alopex lagopus*).

The most remarkable find in many respects was the umiak frame. A photograph of it *in situ* was published in *Arctic* (Vol. 3(1950) p. 13) in a preliminary account of the first wintering of the Danish Pearyland Expedition, 1948–9, written while the expedition was still in the field. During several other sled journeys to the umiak the following year, 1949-50, all wooden

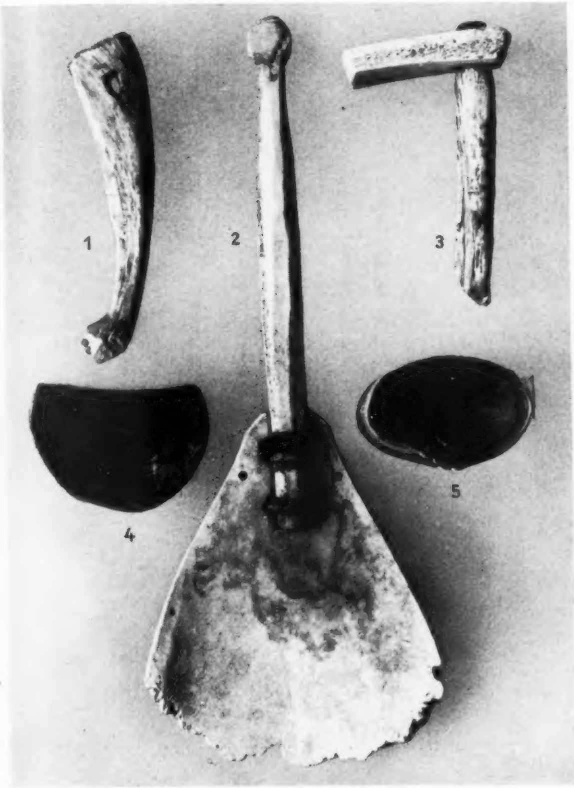


Fig. 2. Thule Culture utensils found near the umiak: (1) adze shaft; (2) whale bone spade; (3) blubber pounder; (4) meat tray; (5) box with baleen side and wooden bottom. Reduction ca. 1:6.

Fig. 3. Umiak paddle found on camping ground 100 metres in front of the boat. Reduction ca. 1:6.

Fig. 4. The umiak rebuilt in the basement of the National Museum of Denmark, Copenhagen, June 1951.

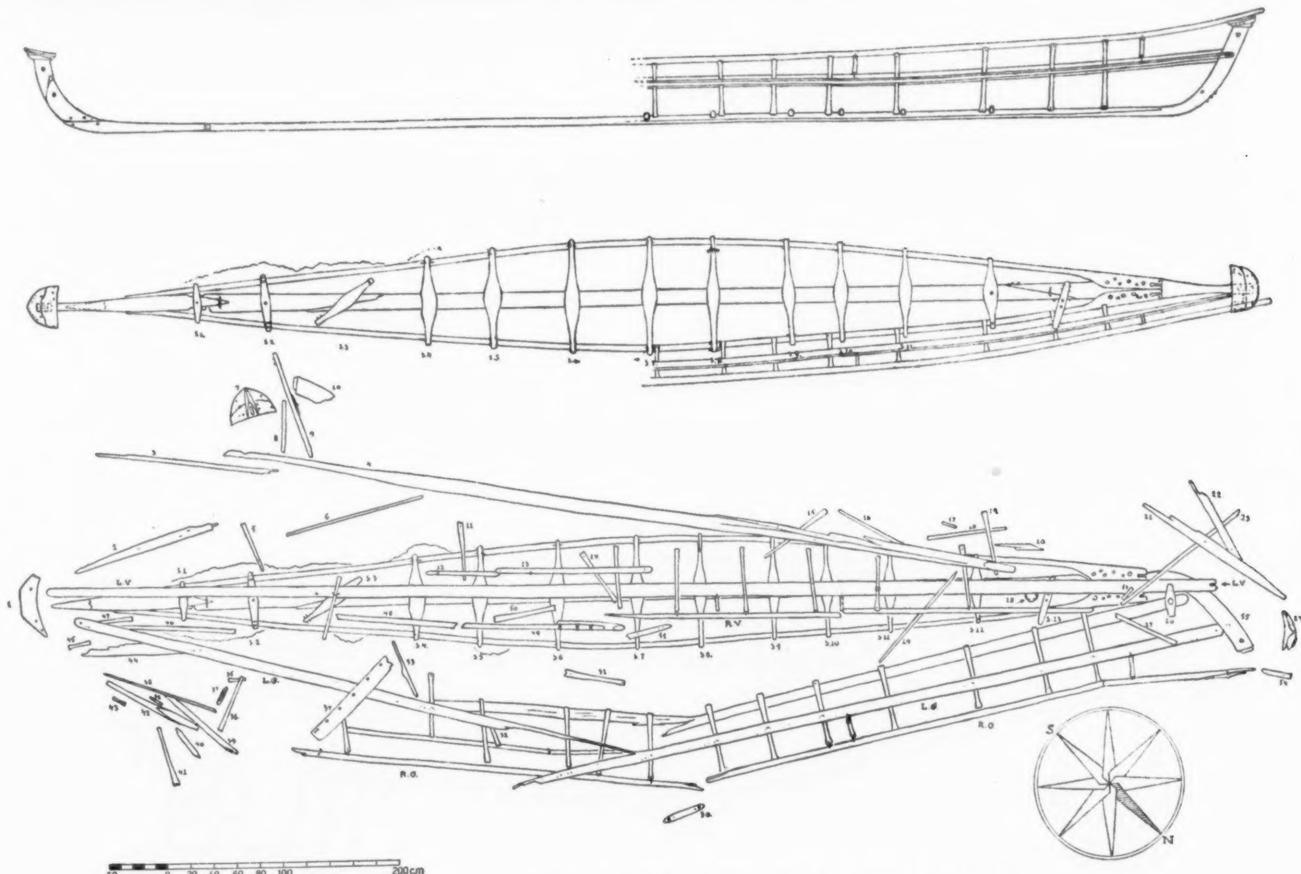


Fig. 5. Above: reconstruction of umiak. Below: umiak as measured *in situ*.

Fig. 6. The last parts of the umiak sawn in pieces, beside the expedition tent at Herlufsholm Strand, May 1950.

parts of the boat were removed to the wintering station at Jørgen Brønlunds Fjord, a small northern branch of Independence Fjord, 125 miles to the west. In the summer of 1950 Catalina aircraft carried the umiak 600 miles farther south to Zackenberg, from where it was taken to Denmark in the hold of the expedition ship. This umiak, which has been rebuilt and is now in the National Museum in Copenhagen, where it is the largest of all the Eskimo boats, probably made a journey no white man has yet completed—the voyage round the north coast of Greenland.

That this is so, can hardly be doubted. At the camping grounds near the umiak no elements from the characteristic Mixed Culture of northeast Greenland (Larsen, 1934) were found which might reveal a connection with the Eskimo from the parts of East Greenland which lie south of Peary Land. In its isolation on the barren coast the find suggested that the whalers did not stay long in the region, moreover, the boat showed signs of repairs and alterations proving that it could not have been built on the spot. These facts can only be brought into agreement if we assume that the immigration took place to the north of Greenland from the west. The boat itself, with its heavy keel plank, 7 x 13 cm in cross section and of greatest width in the horizontal plane, and 13 cross pieces with broad, flat, convex-edged centre parts lying on the plank, confirms this assumption. The keel and the cross pieces in all

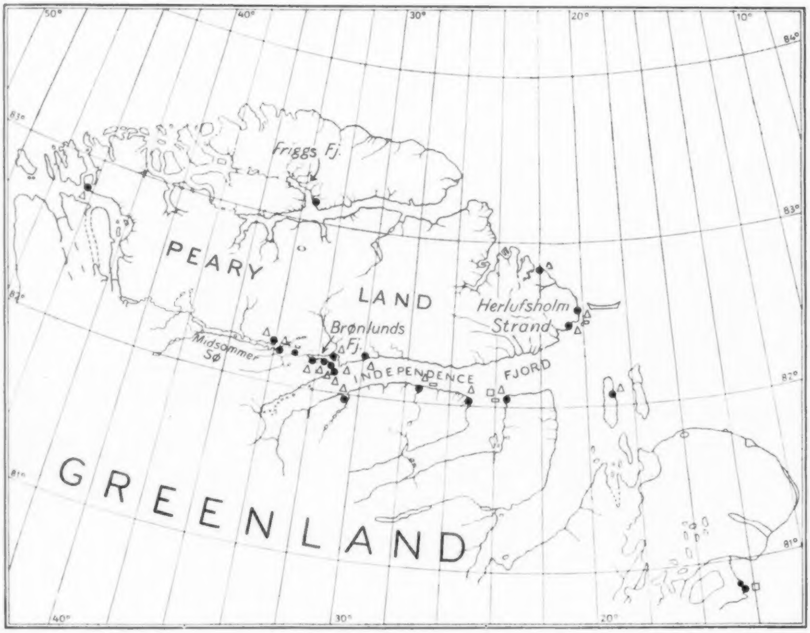


Fig. 7. Eskimo sites found by the Danish Pearyland Expedition, 1947–50. The boat marks the site where the umiak was discovered.

"women's boats", as we know them from Greenland, rest on the edge and to find a parallel it is necessary to go to Alaska. The publications of Collins (1937) and of Geist and Rainey (1936) contain pictures of similar cross pieces from umiak frames found on St. Lawrence Island, and Collins (1937, pp. 158–9) describes an end block from the prow or stern apparently identical with the end blocks from the Peary Land vessel.[1]

The wooden pieces of the umiak were held together with lashings of baleen and big spikes of walrus ivory with barbed points, but a small number of iron nails was also found in the boat. Spruce or larch driftwood was used for the construction, with the exception of a small piece from the port gunwale, which proved to be oak. Somewhere on the journey the Eskimo party must have met with white men or come across the wreck of a white man's ship from the waters west of Greenland, and this cannot have occurred more than 300 years ago. The good state of preservation of boat utensils tells of a much later date for the stay in Peary Land.

The immigration to Peary Land which appears to be represented by the umiak from Herlufsholm Strand seems in the first place to be the eastward spreading from Alaska of the Arctic Whale Hunting Culture. It is known

[1]The writer would welcome information on umiaks or parts of umiaks corresponding to the Peary Land find.

that it populated the Thule district and Inglefield Land in North Greenland by several advances. It must be assumed that remains of pure Thule Culture must have been preserved somewhere in northern Ellesmere Island or on the islands to the west. The well-preserved sleds found by Greely (1888) at Lake Hazen, Distant Cape, and Pim Island in 1882–4 support this theory. From this reservoir of the Whale Hunting Culture the comparatively recent neo-Eskimo migration to Peary Land must have taken place 2–300 years ago.

The Dorset Culture

Our archaeological investigations in the Peary Land area have so far discovered 31 sites with 146 dwelling remains in all, 18 smaller stone rings, 36 fire places, 41 meat caches, and 18 fox traps. Some were situated on the south coast of Independence Fjord, but the great majority were in Peary Land itself, where 25 sites including 121 dwelling remains, 4 smaller stone rings, 23 fire places, and 25 meat caches have been found. They all lie farther north than other ancient settlements hitherto described—the northernmost sites in Friggs Fjord, 83°07N. and 83°12N., being only 470 miles from the North Pole.

The walls of only one of the dwelling remains were sufficiently high for it to be called a "winter house" as we know it from the rest of the Eskimo world. The other dwellings were mostly "tent rings", but in many cases tent rings of a special type which will be discussed later. This type was particularly common in Jørgen Brønlunds Fjord where "Brønlundhus", the headquarters of the expedition, was situated. Here, far from the sea, traces of earlier dwellings were more numerous and closer together than anywhere else in the district, namely 15 sites with 84 dwelling remains, 3 smaller stone rings, 12 fire places, and 21 meat caches (Fig. 8).

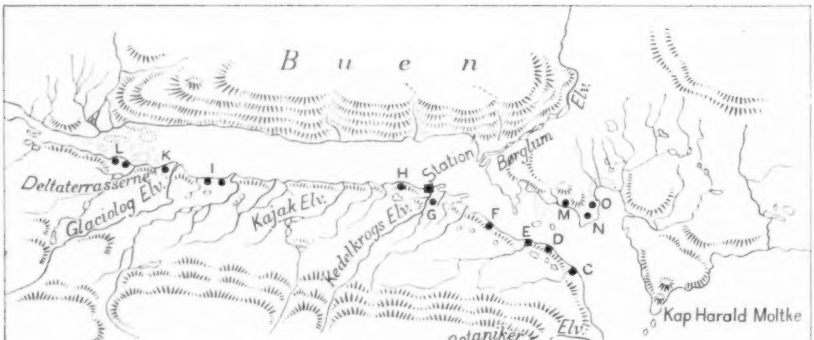


Fig. 8. Eskimo camping sites in Jørgen Brønlunds Fjord.

Fig. 9. Elliptical tent ring No. 5 with mid-passage at Deltaterrasserne, site K in Jørgen Brønlunds Fjord.

Professional Eskimo archaeologists have, in the past, concentrated their investigations on house ruins and paid less attention to the tenting places. Finds from tent rings were rare exceptions and never used as a guide. But Peary Land forced its tent rings on the archaeologist and taught him not to scorn them. It was very fortunate that the tent rings were chiefly distributed along the shores of Brønlunds Fjord, where members of the expedition were confined all summer after the spring sled journeys were over. No other circumstance would have driven an archaeologist to continue his scratchings and rummagings in sterile-looking gravel exactly like the gravel outside the stone circles, when one day passed after another without bringing forth the least bit of bone, wood, or artifact.

But perseverance had its reward, now here, now there, in finds of a tiny flint flake with traces of fine retouching along the edge. In the course of two years these sparse, small finds amounted to quite a collection telling its own story: tiny blades of flint, knife blades, scrapers, one roughly manufactured adze blade, and small flint lamellar flakes or "microliths". The blades in some cases were retouched along the edge to form two or three notches at the back, a measure giving better support to the lashing (Fig. 10, Nos. 16, 20, 21, 22). The convex-edged scraper was comparatively well represented in finely executed, varied forms. At one of the tenting grounds a prepared flint core (Fig. 10, No. 13) was found from which microliths had been struck, the first find of its kind in East Greenland. Examples of the bone tool, or

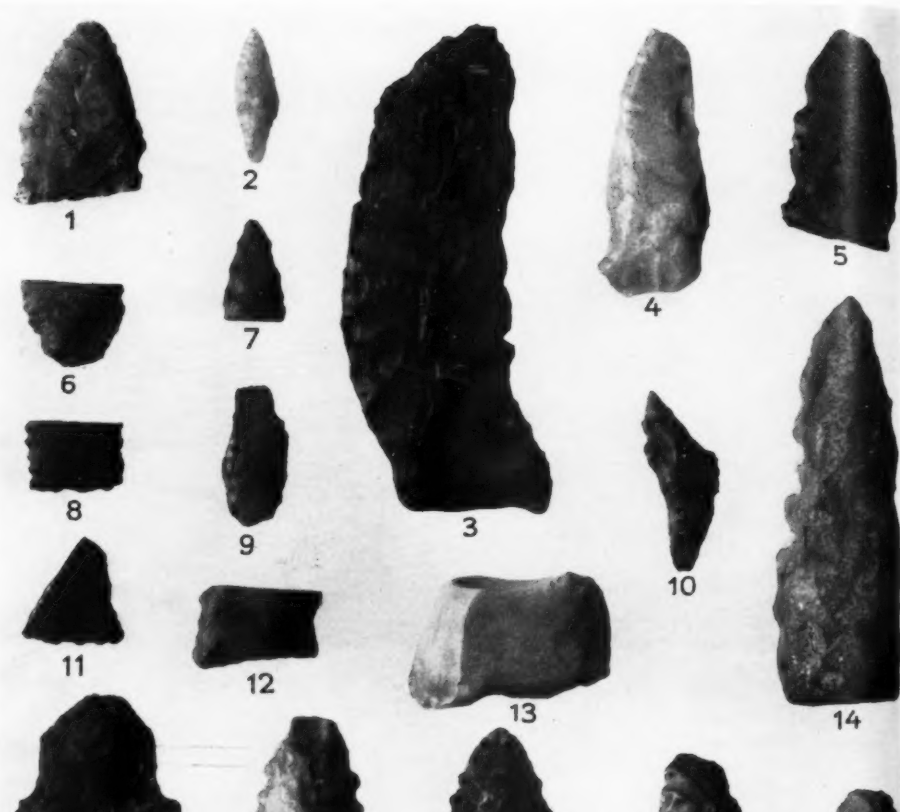


Fig. 10. Dorset flint artifacts from the Peary Land area: (1) projecting point; (2) arrow point; (3)–(5) knife blades; (6), (7) broken points; (8), (11), (12) back ends of knife blades; (9) burin; (10) concave-edged scraper blade; (13) prepared flint core; (14) adze blade; (15)–(18) convex-edged scraper blades; (19) flake scraper; (20)–(25) blades or parts of blades of uncertain use; (26 a–q) microliths. Reduction ca. 2:3.

flint flaker, used for retouching (Fig. 11, Nos. 7–12) were found later, these were small forms used in handles, and are well known, for example, from Ipiutak.

The bone needles found (Fig. 11, Nos. 3–6) often had almost invisible eyes, some of which were oblong, some round. And eventually—after one whole year—a pair of much damaged harpoon heads emerged, a highly desirable find, because harpoon heads usually give a definite indication of the culture. One harpoon head (Fig. 11, No. 1) had a groove at one edge which must have been used for a side flint blade. This type had never been discovered in Greenland, and to find parallels we must once more turn to Eskimo cultures in Canada and Alaska. No less interesting was a burin (Fig. 10, No. 9), the splitting tool, well known from Stone Age Cultures (Upper Palaeolithic and Mesolithic) of Europe. That burins occur at all in Eskimo cultures is one of the most remarkable archaeological discoveries of recent years. They were first found by Giddings (1951) in 1948–9 in the oldest of three deposits at Norton Sound, Alaska, among the culture elements of what he calls the Denbigh Flint Complex. At the time of the Pearyland Expedition burins with microliths and flint cores were also excavated by Irving (1951) and by Lachenbruch and

Fig. 11. Dorset bone objects from the Peary Land area: (1) harpoon head with groove for side blade; (2) harpoon head; (3)–(6) bone needles (4 and 6 with oblong eyes); (7)–(12) points for flint flakers; (13), (16) bone implements of uncertain use; (14), (15) preliminary works of ivory (15 presumably for a harpoon head). Reduction ca. 2:3.

Hackman (Solecki, 1951; and Solecki and Hackman, 1951) in the Brooks Range. In the Denbigh Flint Complex the burins likewise occur in a microlithic layer with polyhedral cores, but more strikingly, they occur with blades of Folsom- and Yuma-type. This deposit was beneath a layer containing flints of Ipiutak and Dorset-like types, representing accordingly an earlier culture stage than these. Finally, Elmer Harp (1951) in 1949 collected flint implements from Dorset sites in southwestern Labrador, at the entrance to the Strait of Belle Isle, and his finds contain not only microliths and burins, but one flint point with basal flutes on both sides, a decidedly Folsom-like feature.

If the Peary Land flint and bone objects, like Harp's finds, are regarded as belonging to the Dorset Culture—and it is at present advisable to do so—they reveal a new side of the Dorset Culture, opening up perspectives on the

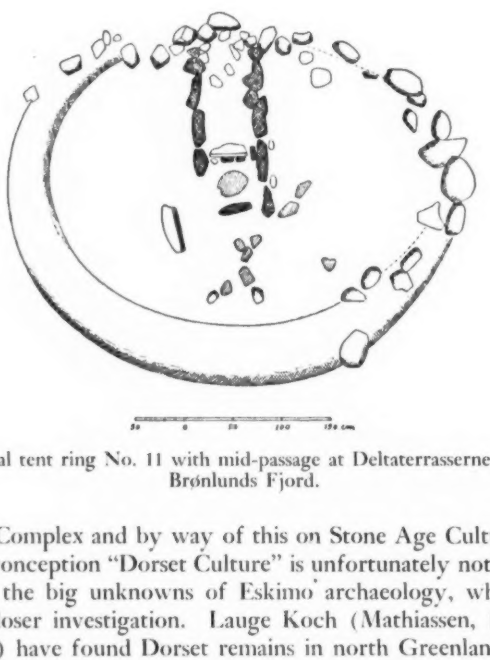


Fig. 12. Elliptical tent ring No. 11 with mid-passage at Deltaterrasserne, site K in Jørgen Brønlunds Fjord.

Denbigh Flint Complex and by way of this on Stone Age Cultures of the Old World. The conception "Dorset Culture" is unfortunately not clearly defined as yet, one of the big unknowns of Eskimo archaeology, which more than ever needs a closer investigation. Lauge Koch (Mathiassen, 1928) and Erik Holtved (1944) have found Dorset remains in north Greenland in Hall Land and Inglefield Land, but compared with these the Peary Land implements are in several respects more primitive, such as in their total lack of ornamentation as well as in the simple forms of the harpoon heads. Other circumstances, too, give a hint of the age of the Dorset settlement in Peary Land. Age is indicated by the sterility typical of the gravel in the tent rings, where neither wood nor bones are found on the surface as they were in profusion at the umiak site. Again, the stones of the tent rings are all deeply polished on the same side by the strong winds, and this must therefore have taken place after the Eskimo had arranged the stones. At certain tent camps the stones must

have been reduced to half their original volume. It is worth mentioning in this connection that the absence of bone material and the evidence of wind polishing were also observed by Harp in Labrador (1951).

The small number of bones found beneath the surface in the tent rings suggests that in accordance with paleo-Eskimo habits the Dorset people lived chiefly by hunting on land, probably on muskoxen and to a smaller extent on reindeer. They probably fished for trout off the river mouths and shot hares, ptarmigan, and brent geese, pursuing their game to the large Midsommer Sø, the lake to the west of Jørgen Brønlunds Fjord, where tenting grounds were found. They do not seem to have built stone fox traps.

Since only a few objects were available for culture determination we had to make a close study of the forms of the despised tent rings (Fig. 9). The

Fig. 13. Tent ring with mid-passage flanked by slender flags on edge at Røde Ø, Dove Bugt, northeast Greenland.

types of these varied in sites where the Dorset implements occurred, but they had certain features in common which are presumably Dorset characteristics: (1) the stones are placed closely together and partly buried in the ground, whereas the stones of the Thule tent rings, also found in Brønlunds Fjord, were scattered on top of the gravel; (2) there is an open fire place inside the tent; (3) slender, long flags are used, standing on edge half-way or completely buried so that only the upper edge is visible; (4) the rings are, as a rule, on sterile gravel terraces much higher up (sometimes 50–60 feet) and farther from the coast (in one case over 200 yards) than is usual for tenting grounds; and finally there is the elliptical type of tent ring, which should also be taken into consideration.

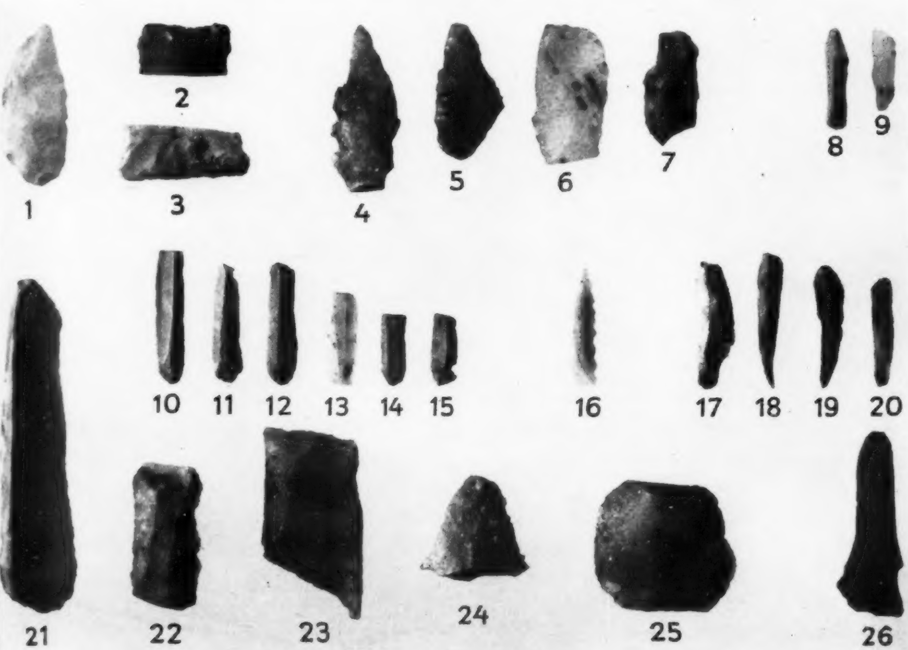
Elliptical tent rings were predominant in one particular locality, Deltaterrasserne, far up Brønlunds Fjord, but were also found elsewhere in Peary Land. These rings consisted of either a stone circle or an almost invisible gravel wall,

with a paved passage flanked by flat stones or slender flags on edge leading from the front wall to the back. Two rows of stones across the central part of the passage marked a square, also paved, and a layer of charcoal and charred bones showed that here was the fire place (Fig. 12).

The absence of real winter houses and the solid construction of the Peary Land Dorset rings must mean that these constructions represent a more permanent dwelling than tent rings in general, and might be termed *tent houses*. The Dorset people may have used these habitations, covered with hides, far into the autumn and possibly the whole year round. This coincides with results of Dorset excavations in east Canada, where indisputable winter houses were also absent. Wintemberg (1939) mentions "low circular piles of rough rocks" as "probably house ruins" on Keppel Island (p. 86), and at Cow Head only "many chipping places and also what were probably fire places" (p. 88). Leechman (1943, p. 366) describes his "houses" at Nuvuk Island as "very shallow circular depressions" in banks of coarse gravelly sand, with hardly any sign of walls. Rowley (1940, p. 496) says of his Foxe Basin site that "unlike the Thule Eskimo again, the Abverdjar natives did not live in stone houses, (though the many fox-bones show that the site was occupied in winter), but in houses, presumably of either turf or snow". And finally the "houses" on Harp's site Port au Choix–2 (Newfoundland) were "shallow round pits" with diameters ranging between 10 and 15 feet (Harp, 1950). They had a hearth in the entrance gap and were surrounded by a ridge under which digging revealed a ring of stones "piled around the exterior edges of a dwelling, possibly to anchor it to the ground." Harp makes the same conclusion as I do, writing that "it seemed, that the aborigines who once dwelt here probably lived in skin tents, all other traces of which had long since disappeared."

Many small features characteristic of the Peary Land tent foundations may be found in tent ruins elsewhere in the Eskimo world, principally in Greenland. The solidly-founded stone arrangements had already been pointed out in the Dove Bugt area, 400 miles south of Peary Land, by Bendix Thostrup in 1907 when taking part in the Danmark Expedition. Thostrup (1911) mentions the elliptical type with mid-passage, and states that it appeared to be much older than the other types nearby. I was able to confirm this statement after visits to the Dove Bugt area, most recently in the summer of 1950 on returning from Peary Land, and in 1939, I found a small adze blade of black flint corresponding to those of the Dorset Culture in such a mid-passage ring on Røde Ø (Fig. 13).

In 1949, when waiting at Zackenberg in Young Sund, 74°30N., the starting place for our Peary Land flights, I found a Dorset site on a high barren terrace. Flint burins also occurred here (Fig. 14, Nos. 4–7) among microliths and chipped flint pieces. A flint side blade (Fig. 14, No. 1), was the first to be found in East Greenland; an oblong flake end-scraper (Fig. 14, No. 21) and a rather thick tool with one corner pointed, probably for graving (Fig. 14, No. 23), must be considered as quite new types in Eskimo archaeology, though the flake end-scraper is known from the European Stone Age, and forms a new link between the cultures of the North American–Greenland Arctic and the



ig. 14. Dorset flint artifacts from Zackenberg, northeast Greenland: (1) side blade; (2), (3) presumably broken knife blades; (4)–(7) burins; (8), (9) burin spalls; (10)–(15) microliths; (16) broken bladeedge with notches; (17)–(20) microliths; (21) oblong flake end-scraper; (22) flake scraper; (23) fragment of thick implement with pointed corner; (24) presumably part of scraper blade; (25) flake disc; (26) pointed flake. Reduction ca. 2:3.

Old World. In Greenland flint implements of the Dorset Culture have now been found as far south as Scoresby Sund, latitude 70° N., and during the last two years Dorset flint implements, have been collected from Sarqaq in Disko Bugt, West Greenland, by H. Mosegaard (Meldgaard, 1952).

Many things indicate that an old Dorset occupation covered most of Greenland, and it is more than likely that the Eskimo remains which according to 'Islendingabok' were found by the Norsemen when they came to Greenland nearly one thousand years ago, were remains of the Dorset people. Rowley (1940) also came to that conclusion on the basis of Dorset finds in Central Eskimo territories reached by the Norsemen on their way to Vineland. The fact that the Norsemen found no Eskimo houses from the "Skrælinger", who had inhabited southwest Greenland before the Norse arrived, has been used to question the veracity of 'Islendingabok'. If, however, it is correct that the Dorset people usually had nothing but tent houses, the argument does not hold good. In southwest Greenland, with its richer vegetation, thickets of willow, alder, birch, or other growths would long ago have hidden the stone rings and, still more easily, the small flint implements of the Dorset people.

One of them may, however, have passed into our hands—a small flint arrow point (Fig. 15) found on the beach in front of the ruin site of the large Sandnes farm at Kilarsarfik in Godthaab district during Nørlund's excavations in 1930 (Roussell, 1936, p. 106). It is not unlike points from Harp's finds.

Fig. 15. Flint arrow point found at Sandnes Farm near Kilarsarfik, which belonged to Thorstein, son of Erik the Red, and after Thorstein's death passed to Thorfinn Karlsefne, who spent two winters in Vineland.

If we look back from Greenland to the Central Eskimo territories and examine Mathiassen's (1927) and more recent workers' notes on tenting grounds there, we again come across the remarkably solid and always high-lying stone rings or stone walls. They are referred to the Thule Culture, but no one has dug them carefully because rich house ruins were close at hand, and finds have never been made in them. Consequently, no one can objectively challenge the assumption that at least some of them are from an old Dorset occupation, which covered large areas of the Eskimo region and was strong enough also to populate Greenland. A hypothesis on such an early Dorset-stage extending over a large territory has recently been put forward by Birket-Smith (1950).

The known Dorset localities today extend from Newfoundland in the south to the northernmost shores of Peary Land. It is to be hoped that more information will be forthcoming on this strange old Eskimo culture the problems of which are of immediate importance to archaeologists. It seems that more clarity on this point is needed for further investigations on the wide subject of the origin of the whole Eskimo culture.

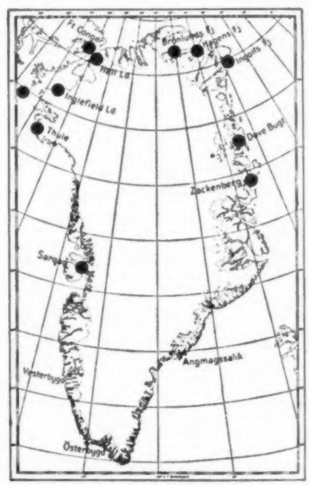


Fig. 16. Dorset finds in Greenland.

References

Bentham, Robert and Diamond Jenness. 1941. "Eskimo remains in S.E. Ellesmere Island". *Trans. Roy. Soc. Can.* Vol. 35, Section II, pp. 41–56.

Birket-Smith, Kaj. 1950. "Nye fremskridt inden for Eskimoforskningen". *Fra Nationalmuseets Arbejdsmark,* København, pp. 81–100.

Collins, Henry B. 1937. 'Archaeology of St. Lawrence Island, Alaska'. *Smithsonian Misc. Collections*, Vol. 96, 431 pp.

1943. "Eskimo archaeology and its bearing on the problem of man's antiquity in America". *Proc. Amer. Phil Soc.* Vol. 86 (1942–3) pp. 220–35.

Frode, Are hinn, Thorgilsson. 1930. 'Islendingabok'. Edited by Finnur Jonsson. København. Vol. VII, Pt. 20, 72 pp.

Geist, O. W. and Froelich Rainey. 1936. 'Archaeological excavations at Kukulik, St. Lawrence Island, Alaska'. *Misc. Publ. Univ. of Alaska*, Vol. 2, 391 pp.

Giddings, J. L. 1949. "Early flint horizons on the north Bering Sea Coast". *J. Wash. Acad. Sci.* Vol. 39, pp. 85–90.

1951. "The Denbigh Flint Complex". *Amer. Antiquity*, Vol. 16 (1950–1) pp. 193–203.

Greely, A. W. 1888. 'Report on the proceedings of the United States Expedition to Lady Franklin Bay, Grinnell Land'. Washington, Vol. 1, 545 pp.

Harp, Elmer. 1950. "A detective story from the far north". *Dartmouth Alumni Magazine*, Nov., 3 pp.

1951. "An archaeological survey in the Strait of Belle Isle area". *Amer. Antiquity*, Vol. 16 (1950–1) pp. 203–20.

Holtved, Erik. 1944. 'Archaeological investigations in the Thule district'. *Medd. om Grøn.* Vol. 141, Nos. 1 and 2, 308 pp. and 184 pp.

Irving, William. 1951. "Archaelogy in the Brooks Range of Alaska". *Amer. Antiquity*, Vol. 17 (1951–2) p. 52.

Jenness, Diamond. 1925. "A new Eskimo culture in Hudson Bay". *Geogr. Rev.* Vol. 15, pp. 428–37.

Larsen, Helge. 1934. 'Dødemandsbugten. An Eskimo settlement on Clavering Island'. *Medd. om Grøn.* Vol. 102, 186 pp.

Larsen, Helge and Froelich Rainey. 1948. 'Ipiutak and the Arctic Whale Hunting Culture'. *Anthro. Pap. Amer. Mus. Nat. Hist.* Vol. 42, 276 pp.

Leechman, Douglas. 1943. "Two new Cape Dorset sites". *Amer. Antiquity*, Vol. 8 (1942–3) pp. 363–75.

Lethbridge, T. C. 1939. "Archaeological data from the Canadian Arctic". *J. Roy. Anthro. Inst.* Vol. 69, Pt. 2, pp. 187–233.

Mathiassen, Therkel. 1927. 'Archæology of the Central Eskimos'. *Rep. Fifth Thule Exped. 1921–24* Copenhagen, Vol. 4, Pts. 1 and 2, 327 pp. and 208 pp.

1928. 'Eskimo relics from Washington Land and Hall Land'. *Medd. om Grøn.* Vol. 71, pp. 183–216.

Meldgaard, Jørgen. 1952. "A paleo-Eskimo culture in west Greenland". *Amer. Antiquity*, Vol. 17 (1951–2) pp. 222–30.

Roussell, Aage. 1936. 'Sandnes and the neighbouring farms'. *Medd. om Grøn.* Vol. 88, 219 pp.

Rowley, Graham. 1940. "The Dorset Culture of the Eastern Arctic". *Amer. Anthropologist*, New Ser., Vol. 42, pp. 490–9.

Solberg, O. 1907. 'Beiträge zur Vorgeschichte der Osteskimo'. Christiania, 92 pp.

Solecki, Ralph S. 1950. "A preliminary report of an archaeological reconnaissance of the Kukpowruk and Kokolik rivers in northwestern Alaska". *Amer. Antiquity*, Vol. 16 (1950–1) pp. 66–9.

1951. "Additional data on the Denbigh Flint Complex in northern Alaska". *J. Wash. Acad. Sci.* Vol. 41, pp. 85–8.

Solecki, Ralph S. and Robert J. Hackman. 1951. "Notes on two archaeological discoveries in northern Alaska, 1950". *Amer. Antiquity*, Vol. 17 (1951–2) pp. 55–7.

Thostrup, Christian Bendix. 1911. 'Ethnographic description of the Eskimo settlements and stone remains in north-east Greenland'. *Medd. om Grøn.* Vol. 44, pp. 179–355.

Wintemberg, W. J. 1939 and 1940. "Eskimo sites of the Dorset Culture in Newfoundland". *Amer. Antiquity*, Vol. 5 (1939–40) pp. 83–102 and 309–33.

INTERACTION OF VEGETATION AND SOIL FROST PHENOMENA†*

William S. Benninghoff
U.S. Geological Survey

In northern lands special problems presented by frost in soils are receiving more and more attention as the pace of construction and settlement increases. Investigations aimed primarily at these problems, notably that of permafrost, have partially revealed the composition and mechanisms of the severe frost climate[1] environment. Parts of this environment owe their nature to the influence of vegetation and soil frost[2] on each other.

In temperate climates the effects of soil frost on plants are so seldom observable that they have been studied in special cases only. In the severe frost climates of high latitudes, and in similar climates at high altitudes, perennially frozen ground and intensive frost action are primary environmental factors in the development and existence of individual plants and of plant communities. Similarly, the fact that penetration of seasonal frost is influenced by vegetation cover is common knowledge in temperate regions but has not required special study. In the severe frost climates, however, plants both individually and collectively strongly modify the occurrence and work of soil frost.

This interaction is the basic mechanism of a dynamic soil–vegetation system in severe frost climates. Undoubtedly these forces are now at work to some degree in the mid-latitudes, but the effects are too slight or too local to have received special attention. Much evidence is being produced to show that intensive frost action exerted strong effects in the mid-latitudes during the Pleistocene glaciations, leaving behind soil features that still have expression in many landscapes (Denny, 1938; Smith, 1949; Raup, 1951). In northern regions, such as Alaska, knowledge of soil frost phenomena and their interaction with vegetation is vital to an understanding of soils, vegetation, and landforms.

Influence of soil frost on plants

The frozen condition of a soil must exert direct effects upon the plant roots contained in it, but the exact effects are little known as most studies

†Publication authorized by the Director, U.S. Geological Survey.

*Presented at Permafrost Symposium, first Alaskan Science Conference, 11 November 1950, Washington, D.C.

[1]"Frost climate" as used here is a climate which includes low temperature periods capable of inducing sub-freezing temperatures in upper soil layers (cf. Troll, 1943 and 1944). A severe frost climate is distinguished by either or both of the following conditions: long periods in which temperatures diurnally cross the freezing point, causing intensive frost disturbance in wet soils, or a mean annual temperature below freezing, inducing development of perennially frozen ground.

[2]The term soil frost is used here because these relationships apply only to frost in the upper layers of the ground; and both seasonal frost and permafrost, in some situations difficult to differentiate, are concerned.

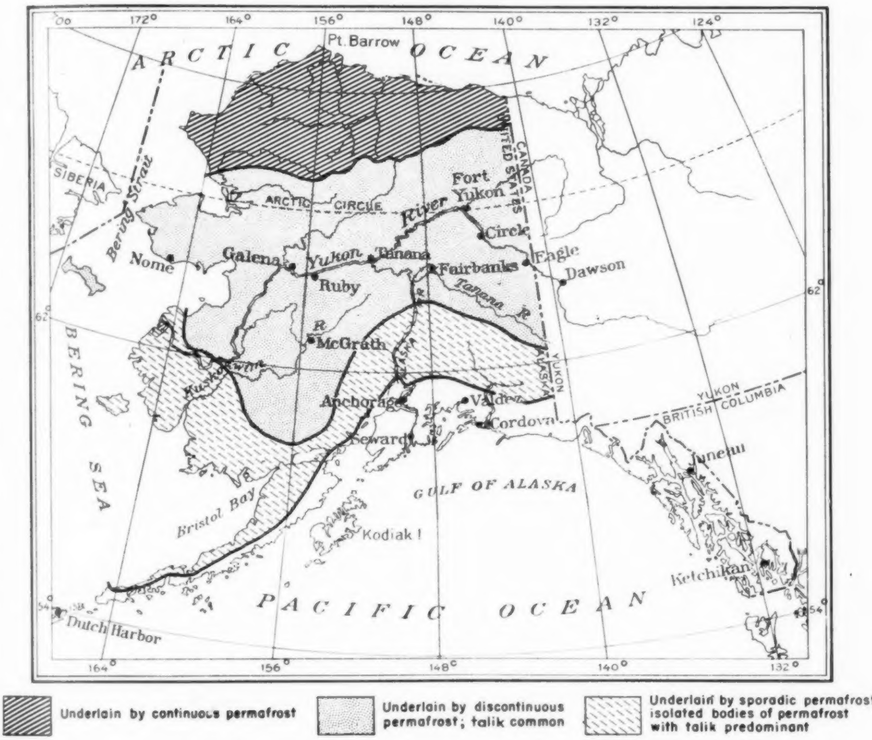


Fig. 1. Generalized map of permafrost distribution in Alaska.

have been confined to frost injury to aerial parts (see titles in Harvey, 1935). In the high latitudes roots are not only encased in frozen material for a great part of the year, but by repeated freezing and thawing, especially during the autumn freeze-up, they are heaved, torn, and split by forces of great strength. In soils unprotected by snow, sudden sharp drops in temperature frequently cause cracks as much as 2 feet wide and 8 feet deep (Zhukov, 1944) with severe damage to intersected roots. In Alaska frost-aided soil movement on slopes and differential frost heaving are intense and occur widely, often radically deforming root systems. By tipping the whole plant, these movements frequently cause deformation of stems of erect perennials as growth of the axial shoot apex is always vertical (Benninghoff, 1950).

Permafrost, or perennially frozen ground, occurs in more than half of Alaska (Fig. 1). In the north, where permafrost is continuous and at shallow depth, the overlying active, or seasonally frozen, layer is generally limited to 8 to 20 inches. Farther south permafrost is discontinuous, as it is interrupted by channels and bodies of thawed ground. Here the depth to permafrost ranges in different places from one to several tens of feet, and the active layer,

4 to 10 feet thick, may or may not reach the top of the permafrost. Near the southern limits of permafrost its occurrence is sporadic, and localities where the active layer extends to the top of permafrost are widely scattered.

Permafrost cannot be occupied or penetrated by living roots, although roots of many native plants are commonly observed close to its upper surface. The shallow, spreading roots of white spruce in soils with permafrost near the surface commonly have ovoid cross sections due to greater annual growth on the upper side. Permafrost at shallow depth in effect creates a shallow soil with a hard impervious substratum. The limitations imposed on the anchoring functions of tree roots in such soils are obvious and are demonstrated by the relative ease with which the trees are overturned. Following a severe storm in 1935, Taber (1943) observed a higher percentage of windfall in the spruce at the tree-line east of Golofnin Sound than among the spruce a few miles away. He cited this as an indication that insufficient depth for the proper functioning of roots limits spruce forest. Pulling (1918), in a study of root habits and plant distribution in the Subarctic, concluded that the success of trees growing on soils with permafrost at shallow depth is related to the flexibility of their root habits. White spruce, with its shallow and flexible root system, was considered best suited. Black spruce, larch, and white birch have shallow but less flexible root systems; and although they have wide ranges on these soils, Pulling believed them to be somewhat less frost-tolerant.

Soil drainage is invariably altered by the presence of frost. Bodies of frozen ground inhibit lateral movement of soil water and prevent downward percolation. Release of water from the thawing of frozen ground may lead to extreme waterlogging of soils. On the other hand, thawing throughout the summer in the upland soils of dry interior Alaska is believed by some observers to provide water for the relatively luxuriant forests. It is probable that frost in the ground, by cooling the upper layers, adds moisture to the soil surface by condensation from the atmosphere.

Plants may be subjected to severe water loss, perhaps to the extent of permanent damage, by exposure to drying winds while the roots are encased in frozen soil and cannot absorb water. Birkengof (1934) concluded that extensive top damage in dahurian larch forests of northeastern Siberia was due to excessive flow of sap to the tops in early summer, when those parts were already thawed out but the lower trunk, roots, and soil were still frozen. Dessicating winds during the long winter have been regarded as limiting to tree growth on frozen ground and this has been cited as an aid to explanation of the fact that the tree-line extends farthest north in sheltered valleys (Taber, 1943).

Soil surfaces are in places rendered unavailable to plants or to certain kinds of plants because of soil stirring, sorting, and transport by frost action. Patterned ground, i.e. surfaces with polygons, pitted tundra, soil stripes, and similar features, gives striking demonstrations of these effects (Antevs, 1932; Polunin, 1934–5; Washburn, 1950; Hopkins and Sigafoos, 1951). Thawing of frozen ground containing unevenly distributed ice bodies results in differ-

Fig. 2. Thaw sink in cultivated field near Fairbanks. Subsidence resulted from thawing of buried ground ice mass.

ential settling of the surface (Fig. 2). This imposes on the surface various minor relief forms, such as hummocks or pits, and thus changes the physical environment for the vegetation occupying the site. Elsewhere sites for vegetation are destroyed by progressive thawing of permafrost. Margins of lakes in areas with high permafrost tables are especially subject to this destruction (Fig. 3). Wallace (1948) described caving lake margins in the Nabesna, Chisana, and Tanana river valleys of eastern Alaska. For these he calculated a mean rate of shore retreat of from 2.3 to 7.5 inches a year. Hopkins (1949), in a study of thaw lakes and thaw sinks in the central Seward Peninsula, pointed out the ephemeral nature of such lakes and evidence of cyclical filling and draining. The oriented lakes on the Arctic Coastal Plain in northwestern Alaska have been shown by Black and Barksdale (1949) to be constantly changing owing to caving of shores, draining, filling with peat, and initiation of new thaw cycles. All these frost processes in the soils demonstrate fundamental features of the severe frost climate environment: instability of the surface and consequent transcience of site conditions.

Influence of plants on soil frost

Plants affect soil frost phenomena most significantly through controls exercised on the thermal regime of the soils, and these controls and resultant effects are probably different for all natural sites. The Yukon River section

Fig. 3. Destruction of spruce forest on caving shore of lake near Fairbanks.

shown in Fig. 4 presents typical permafrost conditions on wooded floodplains in northern interior Alaska. Erosion and thawing by a meandering stream cause the permafrost table to retreat far below the stream bottom level, but it rises under deposits on the slip-off side (Péwé, 1947). The permafrost table rises several feet more in the new alluvium during maturation of the initial balsam poplar forest, and rises still more as that forest is replaced by a dense stand of white spruce.

Vegetation shields the soil from maximum penetration of heat by shading, by decreasing air circulation, by retaining moisture in and just above the soil, and by intercepting rain. Another cooling effect, resulting from evaporation of moisture on plant surfaces, may be significant. Russian workers have demonstrated that mosses play an important part in this effect (Sumgin, Kachurin, Tolstikhin, and Tumel, 1940). Mosses have low thermal conductivity, especially when dry, but also have a large water-holding capacity and

are strongly hygroscopic. They absorb water not only from precipitation but also from atmospheric vapour, the latter being absorbed in direct proportion to the relative humidity of the air. Yet during a dry period they tend to lose moisture rapidly. This is important because the latent heat of vaporization of water at 0°C is 596 gram cal./gram, whereas the latent heat of fusion of ice is only 79.7 gram cal./gram. For example, at the Bomnak experimental station in eastern Siberia (Sumgin, *et al.*, 1940) one gram of *Sphagnum papillosum*, at a relative humidity of 100 per cent on the surface at night and 42 per cent during the day, evaporated 0.2685 grams of water during the day. In this process each dry-weight gram of *Sphagnum* withdrew 155.79 calories from the surrounding environment during the day. After a night with heavy dew, or after a rain, each dry-weight gram of this species of *Sphagnum* is capable of taking up 14.975 grams of water, the evaporation of which would withdraw from the ground-stratum environment 8643.33 calories. In addition to surface evaporation, the evaporation of moisture from transpiration also withdraws heat energy, but the quantities involved are unknown.

It has been common knowledge in Alaska that thawing of frozen ground is greatly hastened by removal of the "moss", a term loosely used for moss carpets, thick turf, and surface peat. Accumulations of vegetable matter are effective insulators in periods of thaw and good conductors when they are frozen in the water-saturated condition (Sumgin, 1937).

S. W. Muller (1943, p. 53) pointed out that dry peat has the heat conductivity coefficient of 0.06 kg. cal./m^2/hr/1°C gradient through one metre thickness. As peat commonly can absorb as much as three times its volume of water, saturated peat can be assumed to have heat conductivity close to that of water, which, in the temperature range 0 to 20°C, is about 0.5 kg. cal., but in the frozen state is about 2.0 kg. cal. Thus during periods of thaw a greater amount of heat is transferred through water-saturated peat into the underlying soil than through dry peat. Furthermore, when water-saturated peat is frozen, heat is transferred from the soil into the air in quantities four times

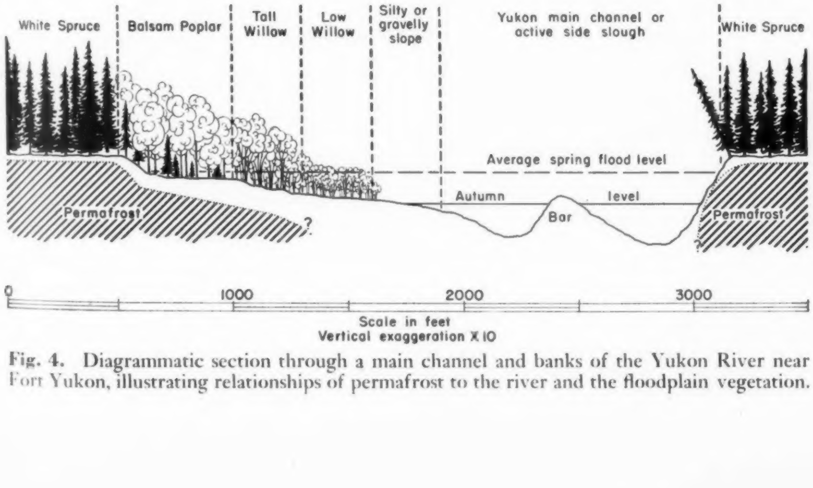


Fig. 4. Diagrammatic section through a main channel and banks of the Yukon River near Fort Yukon, illustrating relationships of permafrost to the river and the floodplain vegetation.

as great as in the thaw periods. Essentially similar properties are recognized in living and dead moss carpets and other accumulations of vegetable matter, although certain factors, such as water-absorbing capacity, vary with different component materials.

Romanov and Rozhanskaya (1946) in studies of seasonally frozen surface peat in a marsh near Leningrad found that the coefficient of heat transmission of frozen samples varied in relation to the amount of air-filled pore space, and that the coefficient of heat transmission of thawed samples changed according to the temperature and to the moisture content. They further determined

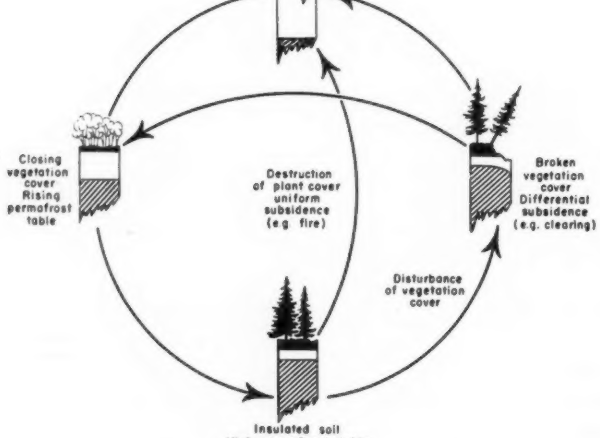


Fig. 5. Outlines of the vegetation–permafrost cycle.

that all physical properties of both frozen and thawed samples depended upon the degree of consolidation and the kinds of vegetable matter constituting the peat.

Although vegetation dominantly favours the accumulation of a cold reserve in the ground, it also contributes to the opposite effect. Vegetation cover decreases air current velocities within its stratum, and thus impedes heat radiation from the soil to the cold air. Tumel (1940) recognized particularly the effect of vegetation cover in impeding ground cooling during the night when air temperatures are lower. The retention of snow by vegetation is important as the thermal conductivity of snow is very low, usually lower than that of dry peat, and the snow cover therefore exerts great influence on the intensity and depth of seasonal freezing of ground.

Plant roots and underground stems have certain mechanical roles in the genesis of soil frost features. These organs serve as binding and anchoring agents in the turf and upper soil layers, and may show remarkable strength and resilience against frost action. Roots and underground stems hold the

turf wall together on the front scarp of turf-banked terraces, and anchoring roots hold back great heavy mats of turf and sod on slopes with unstable soils. Hopkins and Sigafoos (1951) observed on the Seward Peninsula that the anchoring effect of roots, along with the insulating effects of plants and their dead parts, decreased frost disturbance in tundra.

The ground which permits the greatest degree of water penetration usually thaws to the greatest depth (Tumel, 1940). Extensive root systems tend to impede downward percolation of water, and thus restrict thaw. On the other hand, roots, especially when dead and decaying, may provide channels for water penetration and sometimes become loci for the growth of granules and small stringers of ice. Uprooting and other disturbances to roots of larger plants over a high permafrost table can initiate thaw sinks.

Frost in the soil and the associated vegetation cover thus exert dynamic influence upon each other. In many situations this interaction engenders cyclic changes, especially prominent in vegetation–permafrost relationships. A much simplified diagram of a basic type of vegetation–permafrost cycle is shown in Fig. 5.

Applications

The degree of accuracy attained in predicting soil frost conditions by ground reconnaissance or from air photographs is proportionate to the degree of understanding of the interactions of vegetation and soil frost. Vegetation can be a valid indicator of many ground conditions if the signs can be identified and evaluated (Benninghoff, 1950; Sigafoos, 1950). The success of Raup and Denny (1950) in relating vegetation types of the southern Alaska Highway district to ground conditions, and then to corresponding vegetation patterns on air photographs, indicates the potentialities of the method when based on sound botanical and geological understanding of at least type localities within the area. Care in observing vegetation, landforms, and micro-relief features will also contribute to knowledge of the history of local areas and their soils—an approach that can add materially to predictions of soil behaviour.

All processes and conditions mentioned above bear on agriculture and forestry in regions of severe frost climates. In many localities the deleterious effects of soil frost are limiting factors in land use, as, for example, on many lower slopes and valley bottoms in the vicinity of Fairbanks (Péwé, 1949).

Development of farming in interior Alaska has brought attention in recent years to the problems of agriculture in permafrost areas. Some writers consider permafrost conditions "a negative factor", while others consider them "a beneficial factor" for agriculture. The point of view is determined by the problems of particular areas or ground conditions (Tsiplenkin, 1944; Gasser, 1948). The effect on agriculture depends primarily on the particular permafrost conditions in the given area and climatological factors relating to heat exchange.

Clearing of land has a beneficial influence on the thermal regime of the upper layers of soil during the warm months of the year. However, changes in the water relations may result, and should be anticipated. Due allowance

should be made also for the soil becoming colder during the winter (Sumgin *et al.*, 1940).

There is a popular belief that if the permafrost table is near the surface plants benefit by water released during summer thaw, but suffer from the proximity of the cold layer. According to Gasser (1948) experience indicates that after one or two years of cultivation both deleterious and beneficial effects of permafrost on the growth of annual plants become negligible, because the permafrost table retreats beyond the reach of the roots of most annual plants. Nevertheless, the effects of permafrost on drainage and subsidence of ground persist as long as permafrost is present within a few tens of feet of the surface.

Forestry and range-land practices in Alaska must also be adjusted to certain significant relations resulting from soil frost conditions. Raup (1951) has pointed out that slopes modified by intensive frost processes ("cryoplanation") are remarkable for the lateral and vertical uniformity of the covering vegetation. This feature is in strong contrast to conditions in temperate regions where diversity of soils and sites is well developed and reflected in vegetational differences. In places the influence of soil frost activity on the vegetation is so strong that distinct plant communities are regularly associated with a particular type of frost feature. Plant communities in such places must be described, mapped, and managed on the basis of their physical environment.

Plant succession in temperate regions tends to establish more mesophytic conditions in which drainage relations are less extreme. But in regions of severe frost climate, plants commonly generate conditions of extreme lack of drainage and greatly intensified soil frost; in short, the plants frequently destroy the very environmental conditions that favour their growth. Disturbances to the vegetation such as burning and clearing in severe frost climate regions do much more than initiate plant succession that will culminate in the return of the original type of stand. Because of soil frost changes following disturbance, the affected surface and the local environment may be so greatly modified that entirely different communities occupy the site for unknown periods of time.

Construction on soils actively disturbed by frost and on soils with permafrost requires special stabilization and drainage measures. Treatment of the vegetation cover requires careful planning. For example, if a foundation site is to be stabilized by the method of preserving the underlying permafrost, then the maximum preservation of the vegetation cover is necessary, particularly on the south side of buildings. Liverovskiy and Morozov (1941), in a discussion of vegetation treatment in Siberian construction areas, pointed out that the preservation of forests helps to prevent the rise of the ground-water table which, when underlain by permafrost, tends to form bogs and marshes. Brush should be cleared from forests, as it retains moisture and hinders drying air from reaching the surface of the ground. Large trees, on the other hand, retain considerable amounts of moisture around their roots and transpire large amounts, thus they are conducive to drying of the soil. Attention to such considerations during planning stages will pay dividends both during construction and throughout the ensuing period of maintenance.

Proposals for future work

Future investigations along the lines mentioned in this paper should continue and extend observations of the occurrence and expression of soil frost phenomena and associated vegetation under natural conditions, as we still have too few adequate descriptions. Little has been accomplished thus far toward measuring these features and processes, and quantitative data are essential before they can be understood and their occurrence predicted.

Some problems that will be met in this general field and have immediate application to Alaskan economy can be indicated here. For example: to what extent does the thawing of soil frost irrigate the soils of the dry interior, and what measures would favour this aid to cultivation? What is the situation with regard to the release of minerals required by plants from native rock materials under a cold climate and in perennially frozen soils? The effects of cold soils on plants need to be investigated in regard to water and mineral uptake under soil temperature conditions both above and below freezing. The relative slowness of organic decay in Alaska has received almost no attention except through studies of phytopathologic fungi (Baxter and Wadsworth, 1939), yet accumulations of peat and organic soils are primary agents in many of the features discussed earlier in this paper. Field study and experimentation are necessary to determine what plants are most effective in stabilizing these varied soils for different purposes.

Investigations such as these benefit from cooperative efforts of workers representing the several disciplines of science that are concerned with the various elements of the problems. Geologists, botanists, and soil scientists are required for the study of almost every one of these problems, while some require in addition physicists, chemists, and climatologists. Training that leads to a wider "awareness" on the part of each specialist in the natural sciences and the combination of specialists from several disciplines in staffing field research projects is particularly desirable.

References

Antevs, E. 1932. 'Alpine zone of Mt. Washington Range'. Auburn, Maine, 118 pp.

Baxter, D. V. and F. H. Wadsworth. 1939. 'Forest and fungus succession in the lower Yukon valley'. *Univ. of Mich. School of Forestry and Conservation Bull.* No. 9, 52 pp.

Benninghoff, W. S. 1950. "Use of aerial photographs in mapping vegetation and surficial geology in subarctic regions". *Photogrammetric Engineering*, Vol. 16, pp. 428–9.

Birkengof, A. L. 1934. "Za nablyudeniya nad lesnym pokrovom i vechnoy merzloty" (Some observations on the forest cover and permafrost). *Trudy Komiteta po Izucheniyu Vechnoy Merzloty* (Akad. Nauk S.S.S.R.), Tom 3, pp. 41–57.

Black, R. F. and W. L. Barksdale. 1949. "Oriented lakes of northern Alaska". *J. Geol.* Vol. 57, pp. 105–18.

Denny, C. S. 1938. 'Glacial geology of the Black Rock Forest'. *Black Rock Forest Bull.* No. 8, Cornwall-on-the-Hudson, N.Y., 70 pp.

Gasser, G. W. 1948. "Agriculture in Alaska". *Arctic*, Vol. 1, pp. 75–83.

Harvey, R. B. 1935. 'An annotated bibliography of the low temperature relations of plants'. Minneapolis, 223 pp.

Hopkins, D. M. 1949. "Thaw lakes and thaw sinks in the Imuruk Lake area, Seward Peninsula, Alaska". *J. Geol.* Vol. 57, pp. 119–31.

Hopkins, D. M. and R. S. Sigafoos. 1951. 'Frost action and vegetation patterns on Seward Peninsula, Alaska'. *U.S. Geol. Surv. Bull.* 974-C, pp. 51–100.

*Liverovskiy, A. V. and K. D. Morozov. 1941. 'Stroitel'stvo v usloviyakh vechnoy merzloty' (Construction under permafrost conditions). Moscow-Leningrad, 243 pp.

Muller, S. W. 1945. 'Permafrost or permanently frozen ground and related engineering problems'. Strategic Enginering Study 62, U.S. Army Engineers, second printing with corrections, 231 pp. (Litho-printed, Ann Arbor, Mich., 1947).

Péwé, T. L. 1947. "Permafrost and geomorphology in the lower Yukon River valley". (Abstract of paper presented at Cordilleran section of the Geological Society). *Geol. Soc. Amer. Bull.* Vol. 58, p. 1256.

——— 1949. "Preliminary report of permafrost investigations in the Dunbar area, Alaska". *U.S. Geol. Surv. Circular* 42, 3 pp.

Polunin, N. 1934-5. "The vegetation of Akpatok Island: Parts 1 and 2". *J. Ecology*, Vol. 22, pp. 338-95; Vol. 23, pp. 161-209.

Pulling, H. E. 1918. "Root habit and plant distribution in the far north". *Plant World*, Vol. 21, pp. 223-33.

Raup, H. M. 1951. "Vegetation and cryoplanation". *Ohio J. Sci.* Vol. 51, pp. 105-16.

Raup, H. M. and C. S. Denny. 1950. 'Photo interpretation of the terrain along the southern part of the Alaska Highway'. *U.S. Geol. Surv. Bull.* 963-D, pp. 95-135.

*Romanov, V. V. and O. D. Rozhanskaya. 1946. "Fizicheskiye svoystva promerzshego sloya bolot" (Physical properties of the seasonally frozen layer in marshes). *Priroda* (Akad. Nauk S.S.S.R.), Tom 35, No. 3, p. 57.

Sigafoos, R. S. 1950. "Some botanical problems in the interpretation of aerial photographs of tundra areas". *Photogrammetric Engineering*, Vol. 16, pp. 429-31.

Smith, H. T. U. 1949. "Physical effects of Pleistocene climatic changes in nonglaciated areas: eolian phenomena, frost action, and stream terracing". *Geol. Soc. Amer. Bull.* Vol. 60, pp. 1485-515.

*Sumgin, M. I. 1937. 'Vechnaya merzlota pochvy v predelakh S.S.S.R.' (Permafrost in the soil of the U.S.S.R.). Akad. Nauk S.S.S.R., Moscow-Leningrad, 2nd ed., 379 pp.

*Sumgin, M. I., S. P. Kachurin, N. I. Tolstikhin, and V. F. Tumel. 1940. 'Obshcheye merzlotovedeniye' (Ground frost studies). Akad. Nauk S.S.S.R., Moscow, 340 pp.

Taber, S. 1943. "Perennially frozen ground in Alaska: its origin and history". *Geol. Soc. Amer. Bull.* Vol. 54, pp. 1433-548.

Troll, C. 1943. "Die Frostwechselhaufigkeit in den Luft- und Bodenklimate der Erde". *Meteorologischen Zeitschr.*, Bd. 60, pp. 161-71.

——— 1944. "Strukturböden, Solifluktion und Frostklimate der Erde". *Geol. Rundsch.* Bd. 34, pp. 545-694.

*Tsiplenkin, E. I. 1944. "Vechnaya merzlota i ee agronomicheskoe znacheniye" (Permafrost and its influence on agriculture). *Trudy Instituta Merzlotovedeniya im. V. A. Obrucheva* (Akad. Nauk S.S.S.R.), Tom 4, pp. 230-55.

*Tumel, V. F. 1940. "Sezonnoe promerzaniye i sezonnoe protayvaniye gruntov v oblasti rasprostraneniya vechnoy merzloty" (Seasonal freezing and thawing of the ground in the permafrost area): in Sumgin, M. I., and others 'Obshcheye merzlotovedeniye', Akad. Nauk S.S.S.R., Moscow, pp. 53-90.

Wallace, R. E. 1948. "Cave-in lakes in the Nabesna, Chisana, and Tanana river valleys, eastern Alaska". *J. Geol.* Vol. 56, pp. 171-81.

Washburn, A. L. 1950. "Patterned ground". *Rev. Can. de Géographie*, Vol. 4, pp. 5-54.

*Zhukov, V. F. 1944. "Morozoboinyye treshchiny v rayonakh vechnoy merzloty" (Fissures caused by frost cracking in the permafrost region). *Trudy Instituta Merzlotovedeniya im. V. A. Obrucheva* (Akad. Nauk S.S.S.R.), Tom 4, pp. 226-30.

*The original Russian publications were not examined. The information was taken from translations and abstracts derived from various sources.

THE NATIVE GREENLANDER—A BLENDING OF OLD AND NEW

Aage Bugge

Introduction

The impact of modern technology and economics and the influence of new social and educational standards on the native peoples of the far north have increased greatly during the present century. Improved transport, particularly in the air, the needs of defence, and the search for valuable natural resources, have brought many Eskimo in Alaska and Canada and natives of Greenland into direct contact with strong outside influences. Native peoples in the north as elsewhere have often shown astonishing adaptability and a facility for learning quickly. Yet persons most familiar with the peoples themselves are aware of a strange mélange of powerful, long-established traditions and the recently acquired culture and techniques.

Dean Aage Bugge, who is the specialist in Eskimo language for the Danish Administration and advisor on Greenland church affairs in Denmark, writes from long experience of the native people of the Colony. His father was a Danish administrator in Greenland, and he himself was for more than twenty-five years a senior official of the education and church affairs department there. He pioneered the use of modern methods in teaching Danish in the higher schools of the Colony.

The survival of old modes of thought in west Greenland is all the more remarkable when it is recalled that Danish influence has been strong there since 1721 when Hans Egede founded a mission at Godthaab. One reason may have been the Danish policy of limiting outside contacts with the Greenlanders, through the government trading monopoly and the closing of the territory to most non-residents. This long-established isolation is now being broken and it was to throw light on the possible consequences of greatly increased European intercourse that Dean Bugge originally prepared his paper for a meeting of the Greenland Society in Copenhagen. Although he deals particularly with Greenland, his conclusions have applications throughout the Arctic regions and even beyond.[1]

TREVOR LLOYD

"ONCE primitive man has met the so-called 'civilized world', there is no way back." This comment by Knud Rasmussen is undoubtedly true of the native of Greenland, whose path inevitably lies forward. Yet it is important to try to understand his cultural background rather than to ignore it. The Greenlander[2] himself should respect its best features, without becoming too dependent on them. He has no alternative if he really wishes to overcome his isolation and take an active part in the development of his own country.

No people can suddenly break away from traits acquired through centuries, and many early characteristics and ways of thought of the Greenlanders may still be found either on or just below the surface even in the larger settlements. They thrive in the outlying places and will remain at the back of the Greenlander's mind for a long time to come. They are woven into his ways of thinking and are often the hidden cause of actions, even by educated Greenlanders, which may appear unexpected or puzzling to outsiders. The reforms

[1]The text has been translated from a paper in *Det Grønlandske Selskabs Aarsskrift* (1950, pp. 136–44) in Danish and modified slightly for a wider public.

[2]Most Greenlanders are of mixed European and Eskimo origin.

now being carried out in Greenland[1] demand from the Danish people not only an acute awareness of the pressing economic and social needs of today, but also a sympathetic understanding of the Greenlander's basic psychology. This should be kept in mind when government personnel are being trained for work in Greenland.

Now that the old social and economic system is passing and may even disappear, the Greenlanders' mentality will also change, although more slowly. Meanwhile, whether we are aware of it or not, the old and the new—sometimes both naïve and startling grotesque—are interwoven in the present period of transition. The isolation of Greenland and of the minds of its people have now been broken, but even though the most alert and intelligent of them are anxious for closer cultural ties with Denmark and the outer world, the old ways will not be obliterated immediately.

On a recent visit I observed with interest how improved transportation is breaking down some of the distinctions between Greenlanders in the larger settlements and those in the outposts which were once so isolated. Yet we must remember that in spite of modern harbours, new electric power plants, and better houses, places remain where there is still time to repeat the old legends and where traces of the old superstititions may yet be found. An example of one such survival of old traditions is the belief, still held in many places, in the power of "name-giving"—through which a dead person returns in a newly named child. A strong campaign has been waged against this belief in the Greenlandic newspaper *Atuagagdliutit*, yet quite recently I came across an instance of it. Coming back from a funeral, I met a man who said happily, as he pulled along a little boy at his side, "Don't mourn over our dead friend, he is here in front of you—we have just got him back again."

There are two types of Greenlanders, the so-called "open" and "closed" types, with of course many gradations between them. Naturally the "open" one is the most popular for he greets the visitor spontaneously and smilingly. We are attracted by his genuine charm and heart-warming hospitality. The "closed" type is less popular, and from the first days of the Mission has been apt to be misunderstood. Because Hans Egede reacted against these "closed", heavy, apparently cautious Greenlanders, he always characterized them as "cold" people without deeper emotions. He overlooked and underestimated their strong, rather peculiar emotional life. It requires time, patience, and the right spirit to pierce the shell of assertiveness which is part of the typical Greenlander's self-reliance, and which has been a characteristic of some of the best native leaders in the country. The shyness and modesty of many Greenlanders is combined with a deep-seated fear of being laughed at.[2] This may explain in part why some Greenlanders find it so difficult to begin speaking Danish. We meet a similar touchiness among Greenlanders about ill-informed or unsympathetic references to the old Greenland in articles, lectures, or films. When judging his efforts to adapt himself to new conditions, the educated Greenlander expects us to be fair and honest. We must do what we can to

[1]Nielsen, Finn, "Planned reforms in Greenland". *Arctic*, Vol. 4 (1951) pp. 12–7.

[2]In the old days quarrels were settled by trying to make the crowd laugh at an opponent during the so-called "drum-singing".

Photo: T. Lloyd

Old style Greenland turf house.

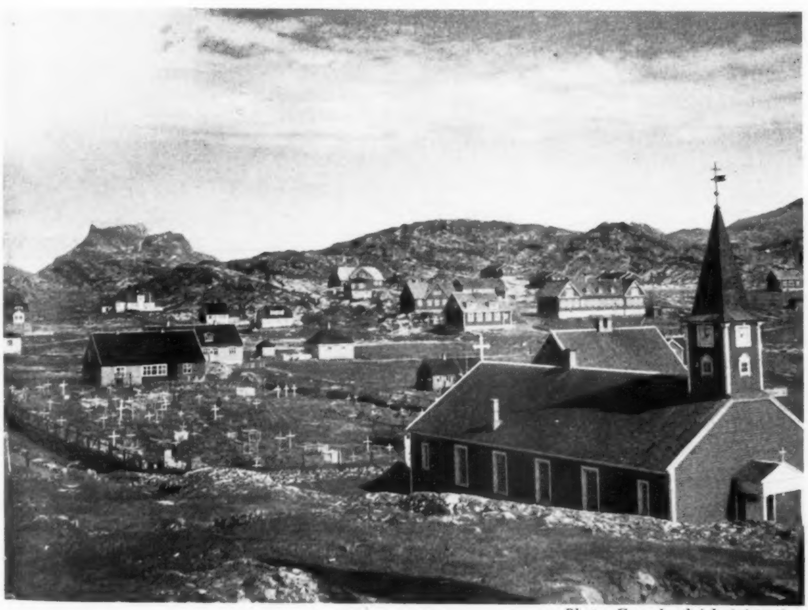


Photo: Greenland Administration

Godthaab.

help his people to reconcile the old and the new, encouraging them to do so by adapting the new ways to their special needs, rather than by merely imitating a Danish or foreign pattern.

One mental characteristic of the Greenlanders is a sometimes almost violent fluctuation between behaviour that is highly emotional and the practical or matter-of-fact. This instability may be traced in part to the old days when the people lived in small isolated groups and close inter-marriage was common. The Greenlander's hazardous life and harsh living conditions necessarily led to a practical or matter-of-fact way of thinking. As a reaction to this we find an emotional life which is really very rich but which often expresses itself in a manner so violent as to border on hysteria or ecstasy. This is as true of their sorrow as of their joy. Their depressions can be very deep and may at times even lead to their becoming lonely wanderers[1] in the mountains. I have seen among them outbursts of grief at deathbeds, which were so violent as almost to leave me breathless.

They also have a reputation for exuberant celebrations. The monotony of their existence seems to create a craving for festivity and gaiety, and if liquor is available, a whole community may be seized by a common psychosis. The attraction of drinking is apparently mainly the common ecstatic experience that it produces. But even without liquor they have 'The gift of festivity'.[2] Among the old folk, one often finds a delightful surge of vitality, which finds expression in dancing and in singing their festival hymns. I recall a day at Taseralik, at one time an important fishing place. All day long there had been a highly festive atmosphere. After the outdoor church service with its vigorous hymn-singing came a wonderful coffee party and we finished up with a football match between teams from the North and South. Then suddenly an old woman appeared. She was dancing on the football field, whirling around among the players with her hands lifted high above her head and with her grey hair-knot swaying.

I also recall a beautiful summer day when, in glorious weather, Umanaq Mountain and the settlement of Umanaq were welcoming the new ship *Umanaq* on her first voyage from Denmark. Towards evening, we were sitting quietly talking together in a Greenlander's home, when we were interrupted by the appearance of a most delightful old woman. She danced and sang as she came in, her song being interrupted now and then by whoops of joy at the sight of the magnificent new ship, their *aterssuaq* (name-sake) which had been called after their own dear Umanaq.

This alteration between the matter-of-fact and the highly emotional may also be met with in the records of the Greenland Mission and Church. We find the desire for the factual in the determination with which the Greenlander clings to the exact wording of the Ten Commandments. Even where his Christianity is at its best, it carries the stamp of Old Testament regard for the exact letter of the text. This, according to the late Dean Knud Balle, may be traced back to an earlier adherence to a long list of taboos. Yet on the other hand we find through the various stages of Christianization of the Greenlanders

[1]So-called *qivitut*.
[2]Title of a book about the Alaskan Eskimo by Knud Rasmussen.

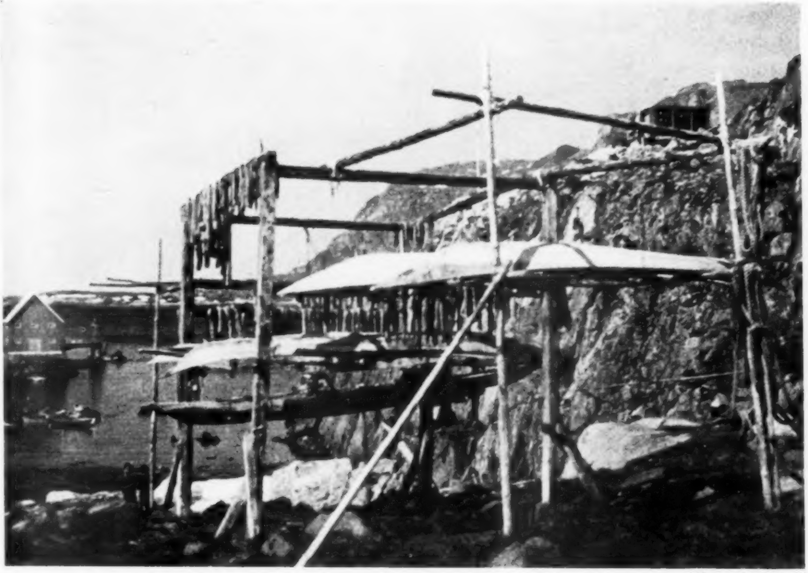


Photo: T. Lloyd

Old Greenland kayaks at Holsteinsborg.

Photo: T. Lloyd

Holsteinsborg shipyard.

Greenlander cleaning skin. Photograph taken about 1910.

Photo: Lars Moller

a craving for ecstasy stemming from the old belief in *angakut* (the medicine men of old) and seances, something which also shows itself in the long, drawn-out hymn-singing of the modern Greenlanders. Viewed from a purely Christian point of view these so-called "cold" people, have surely not shown themselves to be entirely free from emotion. This was obvious during the first century of missionary work when the Moravians, with their highly emotional tendencies, exerted such a strong influence in south Greenland.

In spite of the present lull in church life, we need not conclude that either the Greenlander's inherent materialism, or his new-found technology, will necessarily overcome his natural faith in providence and the Christian spiritual life. The highly emotional, even sometimes visionary, side of his spiritual life, (which has its parallels among the Laestadian sect in Lapland) may still find expression in ways that are deeply moving. An old Greenlander influenced by the vast loneliness of the long winter night, narrated the following:— "My soul was heavy and sad while I stood fishing on the fjord ice one dark winter night. But behold, the fog and the darkness were lit by a radiant glow and Christ came, walking across the ice towards me, and behold, he stood at my side."

One of the most important characteristics of the Greenlander is his conservatism, carrying with it an immovable and deeply-rooted tenaciousness. In *The Greenland Society Yearbook* for 1918 Schultz-Lorentzen[1] calls attention to the remarkable absorbing power of this conservatism. It is interesting as well as important to observe this in the struggle of the Greenlandic language over a period of more than 200 years, to delimit, adjust, and absorb imported ideas and expressions. The language has shown enormous elasticity, although in compiling dictionaries and making translations, one is of course constantly running into words which can be transcribed only imperfectly. The Green-

[1]Schultz-Lorentzen, C. W., "Folkeoplysningen i Grønland, dens Midler og Maal". *Det Grønlandske Selskabs Aarsskrift* (1918) pp. 86–100.

landic language has in many ways reached the limit of its capacity, and among Greenlanders in the larger settlements it is practically bursting with foreign words. Yet, in the opinion of a leading Greenlander, the language shows no signs of dying out. In home and in church, in legends and in songs, in hymns and in literature, it will continue to speak to the Greenlander of something in his innermost being and thus justify its claim to exist side by side with Danish, which is now being increasingly taught in the Greenland schools.

Mention should be made, if only briefly, of a more serious aspect of this conservatism. That is the completely passive side of the Greenlander's character, which may prove to be a great barrier to progress. It stems perhaps from the fatalistic attitude of the Greenlander of old, who believed that "What shall be will be." This philosophy armed him to meet adversity, but it may prove a real handicap in the modern community. It may lead not only to a rather pathetic optimism, but also to a constantly recurring inclination to let things slide. It may lead to recklessness, laziness, and irresponsibility in economic as well as in moral, sexual, and other matters. It may prevent the development of the independent initiative and enterprise which are so badly needed among the Greenlanders.

It must not be forgotten that the Greenlander has a strong and deep feeling for nature. In this, too, one can detect an alternation between an attitude that is robustly practical and one too often highly emotional. Once, when I jumped ashore after a magnificent boat trip on the lovely lake that leads into the Kingua valley, a pearl of great beauty among the woodlands in the Julianehaab district, a Greenlander exclaimed: "Oh! what a fine lot of firewood". Another time when I was reindeer hunting with a Dane and a

Photo: T. Lloyd

High School at Godthaab.

Greenlander, the former wanted to pick some flowers. "Why are you doing that?" asked the Greenlander. "Are they good to eat?" When the answer came in the negative, he shook his head with an indulgent smile, and concentrated on the reindeer tracks.

Yet on the other hand, native legends include many expressions of emotion at the sight of beautiful country. To mention only the classical example—"The great hunter from Aluk",[1] whose heart burst from joy when, after long absence he again saw the sunrise from his own home and watched the rays of the morning sun shatter themselves against the icebergs. This legend is of such beauty and magnificence that it is worthy of being a part of world literature.

Even today this sensitiveness to the beauty of scenery may be met with in speech as well as in writing. I recall some letters from the late Jacob Rosing, who was a thoughtful hunter living in Kangâmiut. He wrote of the impression that had been made on him late one calm and beautiful night when he was returning from hunting. The mountains stood out sharply, silhouetted against the starlit sky above his head and he wrote, "At this sight my thoughts turned in thankfulness towards Him who created all these wonders".

Glancing over the latest edition of the *Greenlandic Songbook*, I found a remarkably beautiful poem by Pavia Petersen. In it he pictures vividly the frozen breath of the coming winter sweeping down from the inland ice through gaps in the mountains. One can almost see a Greenlander rejoicing in the return of the cold weather heralded by the autumn aurora.

To the hunter, the thrill of the chase and the surroundings in which it takes place merge into one. Abel Kristiansen, a senior catechist,[2] told me how a mutual friend, an old hunter, had recently been on a last trip to his old hunting grounds at the head of the fjord. The account ended with these words: "Returning as an old man to my former hunting grounds, I was almost overwhelmed. As we left the fjord early in the morning in glorious weather, with the ice sparkling in the rays of the rising sun, and the water lying dead calm, smooth as a mirror, and dotted with ice-pans, I could not help being deeply stirred at the sight. It seemed as if the whole world was showing me its beauty in a last farewell."

A younger hunter from Frederikshaab wrote: "This morning, as usual, I climbed a hill behind our village to get a good look out. When I saw the ice-filled sea, it took my breath away. As I pictured in my mind's eye the game I should find there, I behaved like a little child gasping for breath from sheer joy. Then I ran headlong down the hill to my kayak."

Perhaps the native Greenlander's well known love of children will, in the long run, leave the deepest impression on his literature. When translating foreign literature for their use, or preparing broadcast programs for them, we should bear in mind that this is something that the Greenlanders readily understand. I remember one evening a large group of us listening to a Greenlandic broadcast of Hans Andersen's "The story of a mother". The native audience heard something of the very best in Danish literature, which because of its subject met a response in their own hearts. It appealed to something primitive and yet beautiful, which the Greenlanders understand—

[1] Rasmussen, Knud, 'Myter og sagn fra Grønland'. 1924, Vol. 2, pp. 23-5.
[2] An unordained native teacher and preacher.

the mother's love for her baby. The audience, made up of all ages, listened quietly to the rather long program. I noticed a child trying intently to catch every word. One young fellow with a troubled look on his face smoked cigarettes while listening, and now and then crushed one with his foot. The greatest tribute and deepest understanding came, however, from a mother who asked me to give her personal thanks to the translator and to the Godthaab radio station. She had herself just lost her son.

In ending, I would like to mention a few *aqautit* or "name-songs" which are sung to most Greenland babies. They are miniature folk songs, primitive and simple, almost crudely simple, and yet they express (most prettily in the native tongue) the Greenlander's love of children. The girls sometimes come in for rather rough treatment, but it is apparently only intended as heavy humour, as for example:

"Oh, these wretched women, they are good for nothing.
They add no meat to the broth
They don't become famous.
Toss them out–throw them away!
Bury these useless women under old chewed bones."

But in my small collection I also find the most touching expression of joy in a new-born baby girl.

"Ane Malia, you dear little Priscilla!
We are so happy about this lovely little baby girl,
We are all so wonderfully happy about her."

And again:

"To think that we poor folk happened
to get this wonderful baby girl.
She should certainly not be looked down on
She really is a sweet little thing."

These fragments of songs are another reminder of that old Greenland, much of which is bound to give way before the rather harsh and practical ways of a new era. Yet the old ways form an indelible part of the Greenlander's character. There is no way back for primitive man once he has met the modern world, yet we must have sympathy and understanding for all that is best in the Greenlander's heritage from the past. We should encourage him to study it and be proud of it.

Let me end by quoting a Greenlandic "name-verse" about a baby boy—hope and pride of the family, looked to as the "Great hunter of tomorrow". Those in Denmark and Greenland who share responsibility for the new nation in the making may see in the words "Great hunter" not only the Greenlander of old, but also the pioneers and leaders of the new tomorrow. We should also remember the mothers of Greenland, who, faced with the pressing claims of a new generation, and with great and new responsibilities, must still find the time to sing their quiet lullabies:—

"Dear little Kâlêraq,
You sweet little thing,
Precious little one,
Who brings my lost one back to me.
You lovely little thing.
Why do I kiss you?
I kiss you because I love you, sweet child.
You darling little baby boy, the great hunter of tomorrow."

REVIEWS

SVALBARD: A NORWEGIAN OUTPOST.

Bergen: J. W. Eides Forlag, 1950. (New York: Bonniers). 8 x 11 inches; 175 pages; illustrations and map. Norwegian Kr. 22.50; U.S. $4.50.

Most probably the first impression of the reader will be that this book belongs to the usual run of "propaganda" picture books which form so large a part of almost every country's export trade. Closer inspection, however, will show that even if there is a certain "propaganda" intent behind the publication of these carefully selected pictures, the descriptive text is unusually well written, factual, and most informative.

The last important general account in English of Svalbard (Spitsbergen) was written in 1920 by R. N. Rudmose Brown. There have certainly been several useful short accounts since then, but these are far from exhaustive and in any case are out of date. It is not suggested that the new book will fill the gap and become a very important source of reference for English students of Svalbard, but, until a new and carefully documented general account appears, it will certainly be the best available introduction to the subject.

In 1947 O. F. Backer, a very talented photographer working in cooperation with the publishing firm of J. W. Eide, visited Svalbard in order to collect material. Unfortunately, he died in that year, before his book had been prepared for press. The publishers decided to continue the work and collected additional photographs. In this they were aided by the Norsk Polarinstitutt. Finally, Professor Anatol Heintz of Oslo University, who has taken part in a number of expeditions to the archipelago, was asked to write the introduction and the detailed captions for each picture. The book was published simultaneously in a Norwegian and an English edition. The English translation, apart from a few minor mistakes, is well above the average.

Almost every aspect of scenery and life in Svalbard is illustrated: coal mining; trapping and sealing; geological features; and flora and fauna. There are many fine photographs of mountains, fjords, and glaciers: all the fascination of Svalbard on a fine summer's day. Strangely enough there is no photograph of so prominent and common a feature as a raised beach, though there is a view across Gipsdalen where the old shore lines stand out fairly well. A number of the oblique air photographs taken just before the war by Norges Svalbard-og Ishavs-Undersøkelser (now the Norsk Polarinstitutt) have been included and help to give a striking impression of the topography of the archipelago. The quality of the photographs and their reproduction is very good, and all the important photographs are up to date. It is regrettable that there is little or no order in the arrangement and that the illustrations could not have been collected under headings such as "coal mining", "bird life", and "geological features". Moreover, too much attention is paid to purely Norwegian achievements—great as these undoubtedly are. A few brief references are made to "foreign" scientific work, but nothing is said, for instance, about the long and important series of Swedish expeditions to the archipelago, nor is there any mention of the many British expeditions, particularly from Oxford or Cambridge. More details should certainly have been given about American pioneering work in the development of coal mining.

Despite this criticism, it cannot be doubted that the book will serve its main purpose well—to attract the more adventurous traveller and to help revive the once flourishing summer tourist trade. Svalbard should appeal to the scientific visitor as well, for there are few places in the Arctic so easy of access and with such magnificent scenery.

J. G. Elbo

THE GEOGRAPHY OF CANADA. *By* J. L. (and M. J.) ROBINSON. *Toronto: Longmans, Green, 1950. 7½ x 10 inches; xii + 205 pages; illustrations and sketch-maps. $2.75.*

Until within the last decade the writing of school texts on the geography of Canada, for Canadian students, was largely in the hands of professionals in other fields. It is therefore most welcome that professional geographers are now contributing such important works. Although the present text is not the first of its kind, it is one of the best yet to appear.

Professor Robinson of the University of British Columbia, the senior and principal author, has studied the country from coast to coast at first hand, and has given particular attention to the vast, little known, federal territories of the northwest. In addition to regional chapters on "Newfoundland and Labrador" and "The Canadian Shield", separate treatment is given to "The Hudson Bay Lowland", "Yukon Territory" ,"The Mackenzie Valley", and "Arctic Islands". Indeed nearly one-fifth of the book is devoted to these six regions.

A frequent query directed toward those with professional interest in arctic lands is: "Where can I find a simple, straightforward, comprehensive description of these areas?" In this book we have an excellent "first reader" source for the Canadian Arctic, written simply and clearly so that high school students may use it readily, and yet with careful attention to the latest research so that the informed lay-reader may also profit.

It is difficult to find fault with a text so generally well designed for its purpose, but improvement in illustration would have enhanced greatly the value of the book. The photographs seem well chosen, but the reproduction is unsatisfactory, sometimes because of over-reduction. The maps are of very uneven quality in both drawing and significance.

In content the weakest part of the book is the treatment of population distribution. The population of Canada is so unevenly spread in each of the provinces and territories (with the exception of Prince Edward Island) that the figures of population, and of population density, for such areas have little or no geographical significance. The dot-map of population distribution for 1941, for Canada as a whole, is virtually illegible. An attempt to map population, perhaps by dots, within each of the areas considered, would have helped the book far more than most of the succession of hard-to-read, too-small-scale, not-very significant maps which are liberally dotted through the text.

Perhaps we ought to re-interpret much of our school approach to geography in terms of exposition of population distribution. Such an approach might have made this very good book an excellent one.

ANDREW H. CLARK

THE BARREN-GROUND CARIBOU. *By* A. W. F. BANFIELD. *Ottawa: Department of Resources and Development, 1951. 10½ x 8½ inches; vi + 52 pages; illustrations, maps, and diagrams. Mimeographed.*

The barren ground caribou is the basis of existence for Indians and Eskimo in an immense area of Canada. The penetration of civilized commerce and transport throughout its range have not diminished its importance in the least. We cannot afford ignorance of such a resource. Here we have, in a concise and invaluable report, the results of an investigation involving thousands of miles of flying and the cooperative efforts of a large number of observers, including several trained assistants. The work was undertaken at the request of wildlife officials of the Dominion and all the provinces assembled in conference, and carried out by the Department of Resources and Development, over a period of three years.

The report is disquieting. Where once large areas were considered fully stocked and numbers estimated in millions, Banfield finds many empty spaces and estimates 670,000 animals. As a necessary background for dealing with the problem of numbers he gives the most complete account yet presented of the life history of the caribou. The movements of 19 herds, all to some degree separate

and permanent entities, are traced. This should be enough to dispel any notion of the unity of the caribou herd. It is not always easy, in fact, to decide whether one or two herds are being dealt with. In familiar areas the reviewer finds that herds he thought he knew have been "lumped" with others. There are some very interesting observations of the behaviour of caribou, including some in contact with wolves. A verified case of bovine tuberculosis is an addition to the pathological record, and the granular tapeworm was also found encysted.

No one investigation or series of investigations is likely to provide all the answers necessary for caribou management. Surely a resource so important should be kept under constant study. It is certain, for example, that even in early days there were great variations in the numbers of caribou. In some years they may very well have been far too numerous for their own good, and in other years there may have been just as few as there are now. However, destructive factors have been carefully studied by Banfield, and are capable of producing the present scarcity, even though there may not be absolute certainty that other influences are not at work. Human utilization, the controllable factor, will have to be reduced until the animals increase. As some of the users are shown to need 100 animals per year, and others less in proportion as they have other resources, it will not be easy to establish an equitable basis for the reduction.

C. H. D. Clarke

MIGRATION OF BIRDS

By Frederick C. Lincoln, illustrated by Bob Hines. *Washington: United States Department of the Interior, 1950. Circular No. 16 of the Fish and Wildlife Service. 9 x 6 inches; iii + 102 pages; maps and line drawings. $0.30.*

Although the fact is nowhere mentioned, this latest in a series of United States Government publications on bird migration is merely a slightly "warmed-over" version of 'The migration of North American birds' by the same author, published as Circular No. 363, United States Department of Agriculture, 1935.

Except for the insertion of certain references to three or four of the more recent developments in migration study, the addition of two appendices, and the expansion of the bibliography, the text of the "new" version is almost word-for-word the same as the 1935 circular. Where minor changes were made, they often led to curious results. For example, the following quotation is from the 1935 version: "During the World War broad areas in the air were under constant close surveillance, and among the airplane pilots and observers many took more than a casual interest in birds. Of the several hundred records resulting from their observations only 36 were of birds flying above 5,000 feet and only 7 above 8,500 feet." These sentences appear *verbatim* in the 1950 version, except that "War" now becomes "Wars" and, for some reason, the word "close" is deleted. The statistics remain unchanged.

Mr. Lincoln is at his best in his delineation and discussion of the flyways of North America. Some of his descriptions have been modified to include information gained in the past fifteen years, and they are interestingly written. However, the section on "Arctic routes" reappears unchanged and indicates in two paragraphs that, in sum, they are tributary to either the Atlantic or Pacific coast routes.

He is probably at his worst in dealing with the influence of weather on migration. The section under that heading appears unchanged in 1950, despite the following points: (1) the validity of his opening sentence: "The state of the weather at any point has little if anything to do with the time of arrival of migratory birds" must be seriously questioned; (2) the association between the advance of migrants and isothermal advances is probably not as close as was once thought; (3) the concept that strong tail winds "interfere with their balance and disarrange their feathers" might well have been omitted, even in 1935.

Since recent European studies of migration are not given consideration, and since the text again deals almost

entirely with North American migrants, the change in title is scarcely a happy one.

The figures have been "brightened up" by the addition of a portrait of the bird in question. This certainly makes for emphasis and decoration, but there is a resultant tendency for some of the figures to become more crowded and less lucid than they were when Wells Cooke first presented them around the turn of the century.

While no one would quarrel with the principle of keeping the salient facts of bird migration before the public, the methods employed in this instance seem scarcely above reproach. The new title, decorative cover, modernized figures, large print and 200 per cent increase in price all imply a thoroughly revised and up-to-date treatment of this subject, something which this circular certainly is not.

At the time of going to press we have received a photographic reduction of this work with hard covers, published by Doubleday at $1.25.

W. W. H. Gunn

CYTOLOGICAL AND EMBRYOLOGICAL STUDIES IN THE AMPHI-APOMICTIC *ARABIS HOLBOELLII* COMPLEX

By Tyge Böcher. *Det Kongelige Danske Videnskabernes Selskab. Biologiske Skrifter. Vol. 6, No.* 7 *(1951) pp. 1-59. Dan. Kr. 9.00.*

Holbøll's rock-cress, *Arabis Holboellii* Hornem., is a highly polymorphic American-Greenlandic species which has long presented many problems to taxonomists. The present discontinuous distribution suggests that the species is a survivor of North American glaciation. It is now most abundant in western North America (Alaska–California) but it is also found about the Great Lakes, on the Gulf of St. Lawrence, and the coasts of Greenland. Western North America is the present centre of variation of the species and, in the author's opinion, is the probable centre of origin. The basic haploid chromosome number is 7; diploid races occur in both America and Greenland, triploid races in Greenland only, and tetraploid and hexaploid races in America only.

In the present study collections of the varieties *typica* and *retrofracta* from Greenland and from Alaska respectively were examined cytologically. Meiotic behaviour and pollen development were studied in detail, and observations on embryology and seed sterility were also made. Diploid and triploid plants of the var. *typica* and diploids of var. *retrofracta* were found. In some diploids the pollen meiosis was regular, in others an apomeiotic development resulted in the formation of pollen with the unreduced chromosome number. Usually the triploids were apomeiotic. Frequently the embryo-sac also followed an apomeiotic development; in such cases the unreduced pollen germinated but fertilization did not follow. It is of interest to note that *Arabis Holboellii* is the only species of the Cruciferae for which apomixis has been reported.

Böcher's work is a contribution to an understanding of the complex taxonomic problems of this species. Further cytotaxonomic study, particularly of the American forms, would be very desirable and would probably be highly rewarding to our understanding of such evolutionary problems.

R. J. Moore

NORTHERN NEWS

Hydrographic work carried out by the *Cancolim* expedition

The Canadian Defence Research Board's 80-foot vessel *Cancolim II* had a very successful summer carrying out hydrographic and oceanographic work in the Western Arctic. The party of nine scientists was led by Mr. T H. Manning (for a preliminary account of the expedition see *Arctic*, Vol. 4 (1951) p. 138); no professional crew was carried.

The *Cancolim* left New Westminster on July 21[1] for Esquimalt, and sailed from there on July 28. She made a remarkably quick trip north, calling at Prince Rupert, Unalaska, and Point Barrow, and arrived at Herschel Island on August 21. Good weather and an exceptionally ice-free season helped the expedition to accomplish more work than had been expected.

Hydrographic and oceanographic investigations were made in the coastal waters of the Beaufort Sea, both off the Canadian mainland and along the entire west coast of Banks Island as far north as Cape Prince Alfred, and also in Amundsen Gulf as far east as the entrance to Dolphin and Union Strait. After leaving Herschel Island the vessel sailed over 4,000 miles carrying out this work. The limits of the continental shelf were defined and the characteristics of the waters investigated.

Besides completing the hydrographic and oceanographic program, a considerable number of biological specimens was collected for the Fisheries Research Board, as well as about 300 birds and mammals for the National Museum. Other scientific work included the establishment of 4 astronomical control points, and special surveys for the Department of Resources and Development.

At the end of the season the *Cancolim* was left at Tuktoyaktuk for the winter. It is anticipated that she will be used for the same kind of work next season. Mr Manning and his party came south by air at the end of September.

[1]Not Vancouver on July 26 as reported in the last number.

Elections in Greenland[1]

The first Greenland Provincial Council (Grønlands Landsraad) to be elected by direct adult suffrage held its opening session on 25 September 1951 at Godthaab. The electoral reform that brought this about was due to a new Act of the Danish Parliament, which became law on 27 May 1950.

Formerly two Provincial Councils, one each for North and South Greenland,[2] were elected indirectly by an assembly made up of chairmen of local councils, Danish officials who had resided more than two years in the country, and members of the previous Provincial Council.

All men and women of Danish citizenship (including all Greenlanders) who are 23 years of age or over and who have lived in Greenland for at least six months are eligible to vote and to run for office.

In addition to the thirteen-member Provincial Council, there are now sixteen District Councils (replacing sixty-six smaller ones), the members of which are also elected by direct universal ballot.

The first elections for the new Provincial and District councils were held on 29 June 1951. Regulations governing the elections were set out in a Royal Decree and in many ways followed those used in Danish municipal and parish council elections. They were however unfamiliar to the Greenlandic election committees, so detailed instructions and a number of printed forms and public notices were prepared in advance and distributed to ensure uniformity. Preparation for the elections began in April 1951, when surface travel to north Greenland was still restricted, so the election material was dropped by aircraft. Local supervision was in charge of committees made up of the former local councils in the sixteen main constituencies. Thanks

[1]Reprinted from the *Arctic Circular*, Vol. 4 (1951) pp. 83–5.

[2]This account deals only with the west coast of Greenland south of Melville Bay. It does not refer to East Greenland or to the Thule area in the northwest.

to this careful preparation, the elections took place without serious mistakes. In two constituencies only was it necessary to repeat the elections: in the most northerly (Upernavik) because ice conditions prevented distribution of some of the lists of candidates in time, and in the southernmost (Nanortalik) because an epidemic of measles, the first in Greenland, kept nearly everyone in bed on election day.

The nomination system caused most difficulty, since it was something new in Greenland elections. In order to be nominated, a candidate needed from five to ten sponsors. In many places election meetings were held by some candidates, and in a few cases there was evidence of a real election campaign, as for example in the capital Godthaab, where the former veteran member of the Provincial Council was defeated by a more progressive candidate after an active campaign. There are as yet no real political parties in Greenland, but in several places fishermen, hunters, or groups of workers and government employees campaigned for their favourites. The rules governing nominations were designed to encourage the formation of political parties, and it is believed that later elections will find them more active.

About 8,750 persons in West Greenland were qualified to vote, and about 6,400 of them actually went to the polls. There they filled in two ballots (one for the Provincial Council and one for the District Council) each with the name of a candidate and a "substitute". On an average 73 per cent of the electorate voted, the highest turn-out being 89.5 per cent and the lowest about 55 per cent.

The elections were the first at which women had been permitted to vote. Many women used their votes and several were nominated. None was elected to the Provincial Council and only one to a District Council. A few Danes were elected to District Councils, but none to the Provincial Council although several stood for election. The new Provincial Council, which met from 25 September to 23 October 1951 under the Chairmanship of the Governor of Greenland was made up as follows:

Constituency	*Name*	*Votes received*	*Votes cast*	*Occupation*
Nanortalik	Jacob Nielsen	130	591	outpost manager
Julianehaab	Frederik Nielsen	184	423	schoolmaster
Narssaq	Gerhard Egede	207	274	clergyman
Frederikshaab	Abel Kristiansen	176	534	catechist
Godthaab	Augo Lynge	567	718	schoolmaster
Sukkertoppen	Peter Egede	210	562	outpost manager
Holsteinsborg	Knud Olsen	97	386	shop assistant
Kangatsiaq	Nikolai Rosing	239	376	outpost manager
Egedesminde	Frederik Lynge	149	413	former colony manager
Disko Bugt (Christianshaab – Jakobshavn)	Marius Sivertsen	141	527	trade assistant
Disko (Godhavn – Qutdligssat)	Jens Olsen	124	602	clergyman
Umanaq	Peter Fleischer	123	549	outpost manager
Upernavik	Hendrik Olsen	147	410	trade assistant

It is noteworthy that all successful candidates were native born Greenlanders and employees of the Greenland Administration. Earlier Councils had included a few hunters, fishermen, or sheep farmers.

Among the first responsibilities of the new Council was the election of two Greenland representatives on the Greenland Committee of the Danish Parliament. The men selected were both schoolmasters: Augo Lynge of Godthaab and Frederik Nielsen of Julianehaab. The Greenland representative elected to the Board of Directors of the Greenland Trading Organization was Frederik Lynge from Egedesminde.

N. O. Christensen
Trevor Lloyd

University of Michigan expeditions to the Aleutian Islands

For the past four years the University of Michigan has sponsored a program of anthropological and botanical field work in the Aleutian Islands. These investigations began in 1948. Support has come from the Office of Naval Research and the Michigan Memorial Phoenix Project. H. H. Bartlett of the University of Michigan Botanical Gardens supervised the program, and T. P. Bank acted as field director of the expeditions. Associated have been A. C. Spaulding, J. F. Bank, H. A. Miller, W. R. Hurt, D. S. McClain, L. H. Jordal, and T. C. Parks.

Expedition members made landings on more than twenty islands for specialized investigations, and ethnological studies were carried out in the five Aleutian villages: Atka, Nikolski, Unalaska, Akutan, and Kasheega. Archaeologists completed major excavations on Agattu, Unalaska, and Amaknak. In addition, most of the known burial caves were revisited for excavation of levels below those previously sampled by Dall, Jochelson, and Hrdlicka.

Ethnological studies in the present villages included surveys of the health and economic status of the Aleuts for an analysis of the trends of acculturation. Fully annotated lists of Aleut plant, animal, and place names were prepared to provide a basis for linguistic comparisons among the various Aleut dialects and between Aleut and mainland Eskimo.

The most recent expedition to the Islands returned to Ann Arbor in November 1951. Collections are being sorted and will be studied at the University of Michigan and at other institutions. Ethnobotanical samples from archaeological strata are being dated by the University of Michigan radiocarbon laboratory.

A number of interesting correlations between anthropological and botanical data have resulted. Phytoecological studies of prehistoric village sites indicate a correlation between former Aleut plant uses and present vegetation and a possible correlation between the latter and age since abandonment of the sites. Ethnobotanical studies reveal the past Aleut plant lore as more extensive and important to Aleut culture than previously supposed.

Archaeological materials have not been fully studied, but preliminary results are interesting. Bank's excavations at Unalaska and Amaknak and Spaulding's excavation at Agattu revealed no separation of culture layers into "Paleo-Aleut" and "Neo-Aleut". Artifacts from Unalaska and nearby Amaknak are different and suggest that one site was older than the other, but it is impossible to prove one mound "Paleo-Aleut" and the other "Neo-Aleut" from present archaeological data. At all three sites there was a gradual change in artifact types from bottom to top, which at Amaknak was much the same general sequence as found by Laughlin at Nikolski (*Arctic*, Vol. 4 (1951) pp. 80–4). Although the two-migrations theory for Aleutian prehistory is by no means untenable there is reason for withholding final acceptance of the hypothesis and the terms "Pre-Aleut", "Paleo-Aleut", and "Neo-Aleut" until more archaeological evidence is at hand.

T. P. Bank, II

1951 Projects at the Arctic Research Laboratory, Point Barrow

During the summer of 1951 eighteen teams of scientists studied northern problems from the Arctic Research Laboratory, of the Office of Naval Research, at Point Barrow, Alaska. The following projects were initiated or completed during the summer season:

Arnold, C. A., R. A. Scott, and J. S. Lowther: University of Michigan.
Paleobotanical research in Alaska.

Brew, John O.*, W. K. Carter, C. I. Shade, H. T. Cain, and R. Tanner: Harvard University.
Archaeological survey of Eskimo, or earlier material in vicinity of Point Barrow.

Deevey, E. S.*, D. Livingstone, and K. Bryan: Yale University.
"Post glacial" history of Point Barrow region, and relevant studies of aquatic ecology.

DeLaubenfels, M.: Oregon State College.
Porifera of the Arctic.

EDMONDSON, W. T.*, G. Comita, and R. Main: University of Washington.
Limnological study of lakes of Alaska.

GUSTAFSON, F. G.: University of Michigan.
Vitamin content in arctic plants.

HALL, E. R.*, J. W. Bee, and J. K. Jones: University of Kansas.
Native land mammals of northern Alaska.

MAYER, W. V.: University of Southern California.
Preliminary investigation of life histories of certain small arctic mammals.

PATRICK, R.*, and L. R. Freese: Academy of Natural Sciences of Philadelphia.
Study of diatom flora of lakes in vicinity of Point Barrow.

PITELKA, F. A., H. E. Childs, and G. S. Greenwald: University of California at Berkeley.
Population biology of arctic land vertebrates.

PRESCOTT, G. W., G. Lauff, and W. Vinyard: Michigan State College.
Survey of freshwater algae.

SETZER, H. W.: Smithsonian Institution.
Distributional, ecological, and taxonomic study of mammals of Arctic Slope of Alaska.

STEERE, W. C., D. O. Steere, and E. Ketchledge*: Stanford University.
Geographical distribution of mosses and liverworts in northern Alaska.

SWARTZ, J. H.*, R. F. Black, M. C. Brewer, and G. MacCarthy: U.S. Geological Survey.
Permafrost.

THOMPSON, D. Q., D. L. McKinley, and B. J. Rose; University of Missouri.
Life history and ecology of lemmings.

VOTH, P. D.: University of Chicago.
Biology of *Marchantia polymorpha* and associated plants in Alaskan Arctic.

WIGGINS, I. L., D. B. Wiggins, and K. Chambers: The Johns Hopkins University.
Taxonomic and ecological investigations of vascular plants in vicinity of Point Barrow.

WILIMOVSKY, N. J. and J. E. Bohlke: Stanford University.
Survey of fishes of Arctic Alaska with reference to those of importance to the military and naval service.

*Investigator not present at Point Barrow.

The Stefansson Library

In December 1951 Dr. Vilhjalmur Stefansson, who is Arctic Consultant at the Dartmouth College Museum, moved to Hanover, N.H., from New York, and placed his library in the Baker Library at Dartmouth College. The Stefansson Library contains some 25,000 volumes, and 20,000 pamphlets and manuscripts, dealing with arctic, antarctic, and permafrost regions. The library is housed in a separate part of the Baker Library stacks and is already available to Dartmouth students and staff and, on application, to other research workers.

Future use of lichen woodlands in Labrador for reindeer

It is not surprising that a Finnish forest-ecologist, while engaged in the study of the forests of subarctic Labrador, besides purely forest ecological problems, should preoccupy himself also with problems relating to the future economic utilization of this vast subarctic wasteland. In some earlier papers, published in Finnish or Canadian journals, Dr. I. Hustich has given the detailed and exhaustive results of his forest-ecological studies; in a recent paper[1] he describes the lichen woodlands of the Labrador Peninsula from the point of view of economic utilization as winter range for domesticated reindeer.

In an attempt to estimate the carrying capacity of the taiga if grazed by reindeer, Hustich first reviews his detailed studies of the rate of regeneration, not only of the lichen cover but of the lichen-forest as a unit. In the evaluation of his conclusions, he has drawn on the literature of the Old and the New World as well as on his personal and very considerable experience with the lichen forests of the reindeer districts of northern Finland.

Hustich estimates that there are at least 105 million hectares (26 million acres) of lichen woodland in Labrador. According to Russian figures such lichen woodland may be estimated to yield 2.5 tons of

[1]"The lichen woodlands in Labrador and their importance as winter pastures for domesticated reindeer." *Acta Geographica*, Vol. 12 (1951) pp. 1–48.

air dried lichen per hectare, or about one half of the amount of lichen consumed annually by one adult reindeer. Allowing for a ten-year period for regeneration between grazing, the lichen forest of Labrador should thus be capable of furnishing good winter pasture for half a million reindeer provided, of course, that the depth and consistency of the winter snow-cover were suitable for winter grazing. As yet practically nothing is known of the winter snow cover of the woodlands of the interior of Labrador. The most serious obstacle, however, to a future large-scale utilization of the Labrador lichen woodlands by reindeer might be the lack of people willing and capable to work there as reindeer herders.

A. E. Porsild

Endeavour Prizes

As a contribution to the meeting of the British Association for the Advancement of Science to be held in Belfast on 3–10 September 1952, Imperial Chemical Industries Limited, publishers of the quarterly scientific review *Endeavour*, have offered the sum of 100 guineas to be awarded as prizes for essays submitted on a scientific subject. The competition is restricted to those whose twenty-fifth birthday falls on or after 2 June 1952. The subjects for the essays are as follows: Scientific research in polar regions; Oceanography; The influence of climate on technology; The origin of life; Sulphur in medicine, science, and technology; and Gas discharge tubes.

The essays, which must be in English and typewritten, should not exceed 4,000 words in length and must be received by 2 June 1952. Only one entry is permitted from each competitior. All entries must be marked "Endeavour Prize Essay" and addressed to The Assistant Secretary, British Association for the Advancement of Science, Burlington House, Picadilly, London W.1., England. The essays should be submitted without signature; the competitor's name and address and date of birth should be given in a sealed covering letter attached to the essay.

In judging the results special attention will be paid to the originality of the approach to the subject, and great importance will be attached to literary style. The competitor's age will also be taken into account.

The successful competitors will be invited to attend the whole of the Belfast meeting, at which the prizes will be presented, and their expenses within the United Kingdom will be paid.

Complete set of the *Meddelelser om Gronland*

The Institute has been informed that one of its Associates wishes to sell a complete set of the *Meddelelser om Grønland*. This series of scientific reports on Greenland originated in 1879 and is now in its 151st volume. All but 15 volumes of the complete set are bound, and they are in very good condition. Offers for this set should be sent to the Director of the Montreal Office of the Institute, 3485 University Street, Montreal, Que.

GEOGRAPHICAL NAMES IN THE CANADIAN NORTH

The Canadian Board on Geographical Names has recently adopted the following names and name changes for official use in the Northwest Territories. For convenience of reference the names are listed by the maps on which they may be found. The latitude and longitude given are approximate only and refer to the first letter of the name except where a precise location is given for a place or a spot height for a mountain.

Admiralty Inlet, 48 S.W. and 48 S.E. (8 miles to 1 inch)

(*Adopted 7 March 1951*)

Baillarge Bay	73°	21N.,	84°	38W.	not Baillargé Bay nor Baillargé Inlet nor Baillarge Inlet nor Biergier Bay
Davids Island	72	20	85	09	
Ebenezer Harbour	72	11	84	58	
English Bay	73	04	84	11	
Ipitalik Peninsula	72	12	80	27	
Johnston Harbour	72	58	84	54	
Levasseur Inlet	72	34	85	44	
Nautilus Mountain	73	26	84	08	not Mount Nautilus
Pisiktarfik Island	72	34	80	25	
Steensby Peninsula	72	04	85	22	not Steensbys Peninsula
The Saw Teeth Hills	72	20	84	48	not The Saw's Teeth (hills)
Tikerakdjuak Mountain	72	09	80	22	not Mount Tikeraqdjuaq
Tununek Mountain	72	02	81	02	not Mount Tununeq
Uluksan Peninsula	73	06	85	42	
Uvajo Mountain	72	09	81	13	not Mount Uvajo

Amundsen Gulf, 97 N.W. and 97 N.E. (8 miles to 1 inch)

(*Adopted 4 October 1951*)

Alexander Point	70°	04N.,	125°	00W.	
Big Booth Island	70	06	125	19	not Booth Island
Bolina Bay	70	01	124	58	
Diamond Rock	70	01	125	21	
Little Booth Island	70	09	125	17	not Booth Island
Maitland Point	70	11	128	20	not Maitland Cape nor Point Sir P. Maitland
Northeast Booth Island	70	11	124	55	not Booth Island
Observation Point	70	39	128	15	
Rabbit Island	70	03	125	13	

Boothia, 57 N.W. and 57 N.E. (8 miles to 1 inch)

(*Adopted 1 November 1951*)

Amituryouak Lake	71°	32N.,	94°	43W.	
Brown Island	71	58	94	08	not Browns Island
Cape Nordenskiold	71	20	92	55	not Cape Nordenskiöld nor Cape Nordenskjöld
Coutts Lindsay Island	70	09	91	26	not Coults Lindsay Island
Goldsmith Channel	71	42	95	29	not Goldsmith Bay
Lady Parry Island	70	11	90	43	not Isabella Louisa Island
Lord Lindsay River	70	05	93	07	not River Lindsay nor Lindsay River
Maneetkalig Mountain	70	03	92	49	not Mount Maneetkalig
Mathe Point	70	27	88	44	
Menchikoff Bay	71	39	93	42	not Menchikov Bay
Nudlukta Inlet	71	42	94	20	
Nudlukta Lake	71	39	94	34	not Nudluhta Lake
Stanley River	70	17	92	30	not East Stanley River nor River Stanley
The Blairs (islands)	70	47	92	30	not Blair Islands nor The Blairs Island
Thiboult Bay	70	58	89	23	not Thiboult Cove nor Thibault Cove nor Thiboult (Thibault) Cove

Clyde, 27 N.W. and 27 N.E. (8 miles to 1 inch)

(Adopted 7 December 1950)			
Ayr Lake	70° 25N.,	70° 09W.	
Clyde (settlement)	70 27	68 31	not River Clyde (settlement) nor Clyde River (settlement)
Clyde Inlet	70 10	69 31	not River Clyde (inlet)
Cormack Arm	70 00	70 06	
Inugsuin Fiord	70 01	68 40	
Revoir Pass	70 29	70 47	
Sam Ford Fiord	70 33	71 06	
Stewart Valley	70 44	71 23	
Swiss Bay	70 31	71 06	
Walker Arm	70 27	71 36	

Cockburn Land, 37 N.W. and 37 N.E. (8 miles to 1 inch)

(Adopted 7 December 1950)			
Barnes Icecap	70° 18N.,	74° 15W.	
Bieler Lake	70 22	73 13	
Conn Lake	70 31	73 43	
(Adopted 5 April 1951)			
Dexterity Harbour	71 33	72 43	not Dexterity Bay nor Hamilton Bay
Maud Harbour	71 49	73 50	not Maude Harbour
North Arm	71 53	76 20	not Manning Fiord
Pollock Head	71 37	73 43	not Polloch Head
Samson Point	71 28	74 00	not Samson Post (hill)
Steensby Inlet	70 22	78 55	not Jorgensen Fiord nor Jungersens Fiord

Cumberland Sound, 26 S.W. and 26 S.E. (8 miles to 1 inch)

(Adopted 5 April 1951)			
Hone River	64° 16N.,	70° 39W.	
Kekertar Island	65 57	67 09	
Koukala River	65 48	71 51	
Pingua Hills	65 55	71 53	not Mount Pingua
Sylvia Grinnell Lake	64 10	69 29	not Jordan Lake
Altered application from previous edition			
Jordan River	64 03	69 19	
Sylvia Grinnell River	64 05	69 17	

Melville South, 46 N.W. and 46 N.E. (8 miles to 1 inch)

(Adopted 6 April 1950)			
Barrow Falls	67° 20N.,	81° 26W.	
McCaig Bay	67 46	81 46	
(Adopted 2 August 1951)			
Brooks Bluff	66 12	84 28	
Cape McTavish	67 41	86 40	not McTavish Point
Cleveland Harbour	66 15	85 22	
Culgruff Inlet	66 49	84 40	not Culgruff Creek
Curtiss River	67 17	87 49	
Naguak Lake	67 11	82 49	not Naguaq Lake
Norman Inlet	66 51	84 20	not Norman Creek
Panalik Point	66 03	85 58	
Prince Albert Hills	67 28	86 13	
Sherer Inlet	66 53	84 42	not Sherer Creek
Altered application from previous edition.			
Aivilik Point	66 30	86 29	
Cape Watt	67 24	86 40	
Point Belford	66 21	83 12	

Southampton Island South, 45° N.W. and 45 N.E. (8 miles to 1 inch)

(Adopted 7 March 1951)			
Back Peninsula	63° 43N.,	80° 11W.	not Back Island
Cape Prefontaine	62 59	82 14	not Cape Préfontaine
(Adopted 2 August 1951)			
Anderson Brook	63 39	81 03	not Anderson River

Sverdrup Islands, 69 N½. and 59 N½. (8 miles to 1 inch)

(Adopted 5 April 1951)			
Hyperite Point	78° 07N.,	89° 32W.	not Hyperit Point

Bay

ens